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William H. Draper, Jr.

In this issue:

MANAGING OUR RESOURCES FOR DEFENSE & PROSPERITY

William H. Draper, Jr.,
Presidential Advisor on U.S. and Allied Defense Problems

Dr. Herbert F. York,
Director of Defense Research and Engineering, Department of Defense

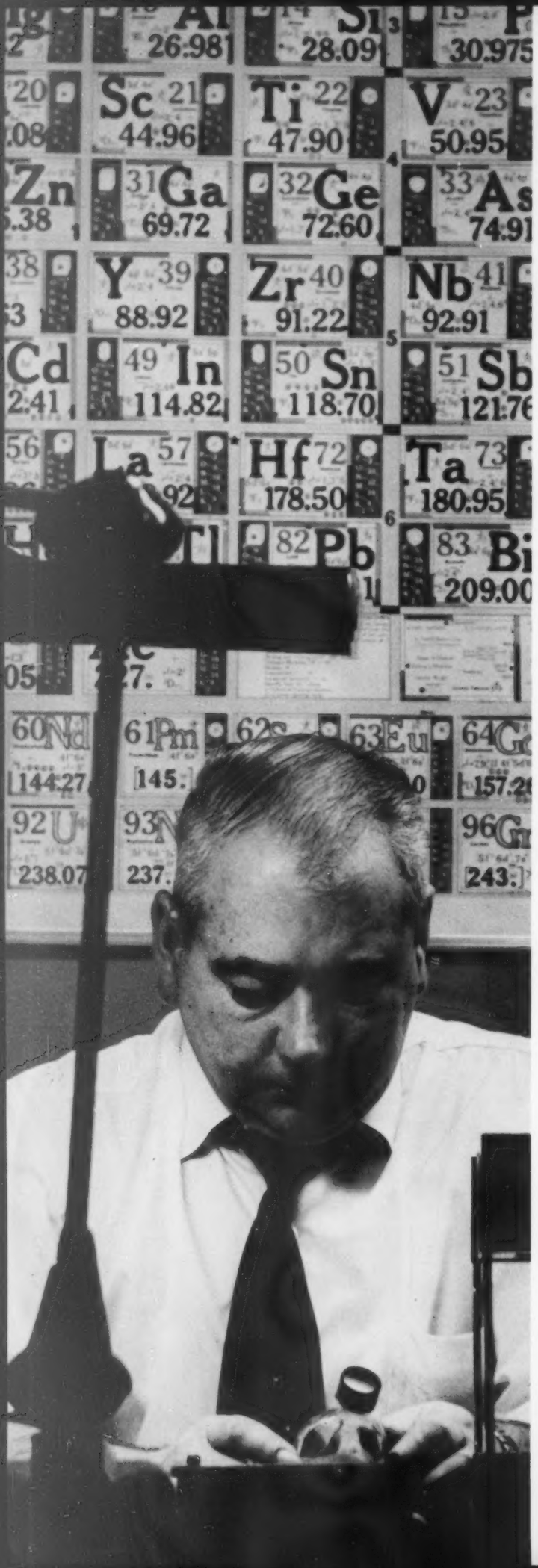
George F. Metcalf,
Regional Vice President, General Electric Company

Dr. Eli Ginzberg, Director,
Conservation of Human Resources Project, Columbia University

Philip Sporn, President,
American Electric Power Company

Vance Brand, Managing Director,
Development Loan Fund

A Panel Discussion by McGraw-Hill Publication Editors:
AVIATION WEEK, BUSINESS WEEK, ELECTRICAL WORLD, ELECTRONICS, NUCLEONICS



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THE GENERAL ELECTRIC DEFENSE QUARTERLY

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General Electric believes that great value will flow from the presentation in these pages of thoughtful, stimulating and sometimes controversial points of view. It should be emphasized, however, that the opinions of the authors are their own and do not necessarily represent the views of the General Electric Company.

Managing Our Resources for Defense and Prosperity

Harvard's J. Sterling Livingston tells this story: At the beginning of World War II, Donald Nelson, Chairman of the War Production Board, asked Stalin what he would like from America to help him fight the war. Stalin replied that the one thing he would like, he couldn't have: the competence of American business managers. If he had that, he said, he could provide all the other requirements himself. Since then, the Soviets have borrowed all they could borrow—including decentralization and high individual incentives—with notable successes.

The U.S. response then to today's Soviet threat must be to do better what Russia has admitted we know how to do best. We must direct increasing emphasis toward sound business management of our total U.S. resources: manpower, energy, transportation, scientific, industrial, natural.

We have no corner on the world's resources, and we need only glance at the Soviet-Sino-Satellite portion of the map to see how great are the "resources" being mobilized against us. It is evident that we could quickly squander our resources, deplete our economy, and weaken our defense posture if we should fail to recognize the almost overwhelming challenge.

The challenge to management, as posed by our national leaders, is threefold, and we are told that we must plan for them in parallel:

1. Defense and deterrence;
2. World peace through disarmament or arms reduction; and
3. International economic competition.

The simultaneous execution of all three depends heavily upon good management by the private businessman. To illustrate:

- *Defense and deterrence* have become a way of life in our modern world, and—unfortunately—we have been given little reason to believe that the need for strength in this area will not be with us for the foreseeable future. Can industry provide the wherewithal to support national defense programs for as long as a military threat exists? Can the businessman manage his resources to provide the nation with technological pre-eminence in the face of curtailed defense budgets and shrinking dollars?

- On the issue of *world peace:* paradoxically, while continuing to probe for new weapons technologies, we must plan our resources to handle the possibility of disarmament or arms reduction. U.S. leaders caution that even though the Soviets might join in some acceptable arms control arrangement, this has nothing to do with any belief that Mr. Khrushchev has been converted to genuine peace-loving status. Should there be any phase, form or degree of disarmament, the businessman will be found squarely in the middle. Effective, enforceable disarmament is replete with scientific problems which grow more difficult and different daily, and may require industrial research—technical and economic, as well as political—approaching the complexity we now know in much of our weapons development.

- Meanwhile, the businessman cannot ignore what might well prove to be the decisive battle between Communism and free enterprise: *economic competition*. Should the Soviets be induced into accepting a legitimate arms control, it is no secret that they would be using all of the resources and energies they might save on armaments for all-out economic warfare; and while economic warfare is better than nuclear warfare, it can be painful and very expensive. Is the U.S. businessman, in cooperation with the government, effectively realigning his sights? Is he planning and organizing to participate and compete on a global basis?

Never has the U.S. businessman been in a position to compete so effectively in all fields. New management techniques, scientific innovations, financial soundness, a broad base of private ownership, tremendous reserves of human and natural resources—these give us (as a nation) an inherent flexibility and capability superior to that which any centrally controlled state system can offer. But our position is weakened whenever any force interferes with either strong government leadership or with industry's normal competitive processes.

In this issue of the DEFENSE QUARTERLY, we examine resources management: what, basically, we have to work with in doing the job. In the next issue, we shall examine the job itself—Total Defense—the end result, including the roles of the Services in helping to deter any form of aggression, from subtle maneuvering to direct nuclear assault.

THE SOVIET THREAT AND OUR

by William H. Draper, Jr. *Presidential Advisor on U.S. and Allied Defense Problems*

As Chairman of the Presidential Committee on U.S. Military Assistance, Mr. Draper traveled throughout the world, consulting top military leaders, unified commanders and key State and Defense Department officials. He directs this insight toward:

- How serious is the Communist threat?
- Is there any change in Russian intent to dominate the world?
- What about the Red Chinese threat?
- Are we applying our resources wisely?
- How important is future Military Assistance?

When William H. Draper, Jr., gave President Eisenhower his committee's final report on U.S. Military Assistance just last August, it highlighted an active career as financier, soldier and diplomat.

In government, Mr. Draper has served as Under Secretary of the Army, an appointee of President Truman as U.S. Special Representative in Europe to coordinate the Mutual Security Program, and a U.S. representative to the North Atlantic Treaty Council.

As a military man, Mr. Draper commanded a World War II infantry regiment in the Pacific Theater, then served with the rank of major general as Economic Advisor to General Lucius Clay, postwar Commander-in-Chief of U.S. forces in Europe. He attended the Moscow Conference of Foreign Ministers in 1947 as Military Government Advisor to Secretary of State George Marshall.

Mr. Draper, the businessman, currently is a partner in the investment firm of Draper, Gaither and Anderson, which operates in the San Francisco area. He recently retired as Chairman of the Board of the Mexican Light and Power Company, the largest private enterprise in Mexico.

RESPONSE

For months, increasing world interest has been focused on the time when Mr. Khrushchev would be meeting at the Summit with President Eisenhower, Mr. Macmillan and General de Gaulle. As I write this, their meeting is only a few weeks away. We have all hoped that some start will be made there toward controlled disarmament under a workable built-in inspection system. Whether this will happen—and whether the recurring Russian demands for neutralizing and weakening West Berlin will be successfully countered—only time can tell.

Already it is clear that the gathering this spring will mark not *the* Summit meeting, but the *first* of a series of Summit meetings. Communism and democracy are opening cold-war peace negotiations, but at best they will be long drawn out, and the outcome may be in question for years.

Perhaps the undoubted desire for peace by the Russian people will eventually permit an acceptable agreement. Perhaps the often expressed Soviet intention to dominate the world will change. Perhaps the many promises to increase the Russian standard of living will really substitute butter for guns.

Or perhaps the present Soviet smiles which, despite friendly words, have so far offered no real change in fundamental positions, are only tactics such as those predicted and suggested by Lenin. We do not know as yet.

How Serious Is the Communist Threat?

In the meantime we must face up to the Communist threat as it actually exists today and be prepared to meet its growing potential tomorrow. How serious is that threat? Is it still primarily military? Will it soon be largely economic? And how must we—the United States—respond, to assure for today *and* tomorrow both an adequate defense and a sound economy? Our own national survival may well depend on a correct evaluation of this challenge, and on the vigor and intelligence of our response.

A year ago President Eisenhower asked a nonpartisan Committee, appointed to consider the United States Military Assistance Program, of which I had the honor to be Chairman, to recommend the most suitable means to insure the Free World's defenses. Members of the Committee visited most areas of the world and consulted our top military leaders and unified commanders and the highest civilian officials of the State and Defense Departments, including our ambassadors throughout the world. All secret documents bearing on the problem were made available and were carefully considered. Based on all the above consultations and studies, the Committee assessed the reality, the magnitude and the possible impact of the Communist threat.

This Presidential Committee included three well-known military men: General Gruenther, Admiral Radford, and General McNarney. Its seven civilian members included two former Budget Directors, Joseph M. Dodge, Republican, and James E. Webb, Democrat, as well as John J. McCloy, head of the Chase Bank and former High Commissioner of Germany, George McGhee, former Assistant Secretary of State, Marx Leva, former Assistant Secretary of Defense, and Dillon Anderson, former Presidential Assistant for National Security Affairs.

These men, taken as a group, have exercised very broad governmental responsibilities—military, diplomatic and economic—during and following World War II. Their combined experience has been very large indeed.

The President of the United States with Mr. Draper and members, counsel and study coordinators of the President's Committee to study the U.S. Military Assistance Program, November 1958–August 1959.

". . . the Soviet threat
is greater than ever before,
. . . its challenge
. . . is steadily growing . . ."

The Committee unanimously concluded last August that the Soviet threat is greater than ever before, that its challenge to the Free World is steadily growing in all of its aspects—political, economic, military and subversive—and that this challenge can only be successfully met through a more positive individual and national dedication on our part.

Lenin's Prediction

Long ago Lenin openly predicted the successive steps in conquering the Western world: "First we will take Eastern Europe; next the mass of Asia; and finally, we will encircle the last bastion of capitalism—the United States. We shall not have to attack it; it will fall like over-ripe fruit into our hands." Since this prophecy was made, Eastern Europe and most of China have fallen to Communism. The more recent threat—"We will bury you!" —from Russia's present leader is hardly reassuring.

During the past months there has been much talk of peaceful co-existence. Moscow has stressed the so-called spirit of Camp David and has been predicting a thaw-out in the Cold War.

Unfortunately, no single concession in the hard core Soviet position that prevented agreement at the foreign ministers' meetings last year has yet been announced. The Russian attitudes toward Berlin, toward the two Germany's, toward disarmament, have hardened despite predictions of peace.

In my own judgment there is no proof nor even any clear indication of any change in the Russian intention to dominate the world.

We do know that strength alone is respected by those with whom we will soon be negotiating, and that this would be the worst possible time to relax and to show weakness.

The Soviet threat, real as it is in the military sense, runs through the entire spectrum of international life.

As our Committee pointed out:

"The international objectives of the Communists, which their leaders have repeatedly stated, are being coupled with their related and rapidly expanding domestic and international economic activity. The Soviet Union is making a military expenditure comparable to that of the United States. Also, they are maintaining a higher rate of growth both in industrial production, particularly evident in direct military supporting industries, and in advancing the state of their technology and technical education. Their objective of equalling and exceeding the United States in selected areas of their own choosing has provided an unusual psychological stimulation to their people which we must more than match by dedication to our own cause."

U.S. Can Call the Tune

Our own total national production is still more than twice that of Russia. Our basic industry is far greater than theirs—our agriculture is far more efficient and produces great surpluses, while great areas of Russian agriculture are still subject to shortage.

We as a nation *can* call the tune if we decide to do so. We have the resources, we have the energy, we have the skills. But it will require a basic decision on our part that, as a nation, we really want to excel, and that we are willing to pay the price. Then over the years

Open-hearth furnaces at the Kirov Iron and Steel Mill, Makayevka, U.S.S.R.

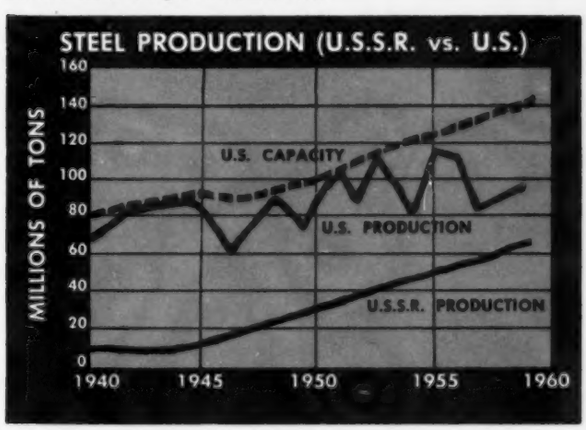
Sovfoto

it will take both will power and staying power to make our decision stick.

Today, with only half our annual product, the Soviet makes as great a total military effort as our own by devoting twice the percentage of total national production that we do to military purposes. In recent years they have also shown a national rate of growth twice our own, so the problem becomes more acute each year.

We, with our much higher standard of living, devote *three quarters* of our greater national production to consumer goods and to luxury items. Russia's people accept a much lower living standard and consume for that purpose less than *one half* of her much smaller total product. And they devote the difference to matching us in defense, to surpassing us in space exploration, and to building up her basic industries faster. These varying percentages are a matter of simple arithmetic that show how we and Russia are using our resources today. They also explain and add up to the Soviet threat to our way of life.

Source: Industrial College of the Armed Forces



Should these current trends continue on both sides of the Iron Curtain, and should the Soviet economy continue to grow faster, Soviet military expenditures would soon largely exceed our own. This would mean an even greater long-range threat to our security, and could mean Soviet domination and victory without war, as Khrushchev now confidently predicts.

Challenge to the U.S. and Free World

This challenge to the United States and to the entire Free World calls for a greater understanding by our people and an over-all response that is more than a military answer.

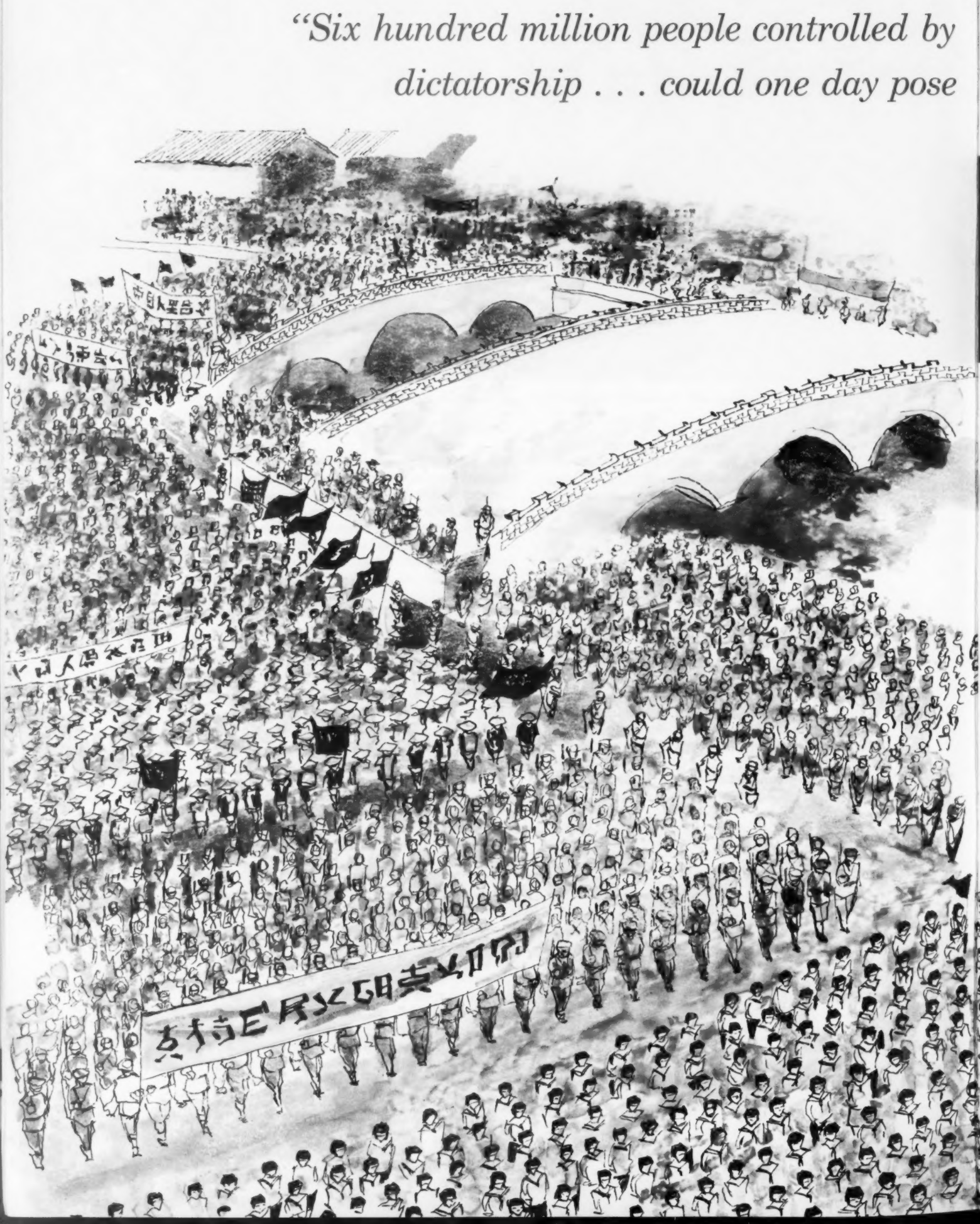
In our Committee's words:

"It requires a positive individual and national dedication, greater emphasis on hard constructive work and thought, less rather than more emphasis on leisure, more rather than less application to our tasks.

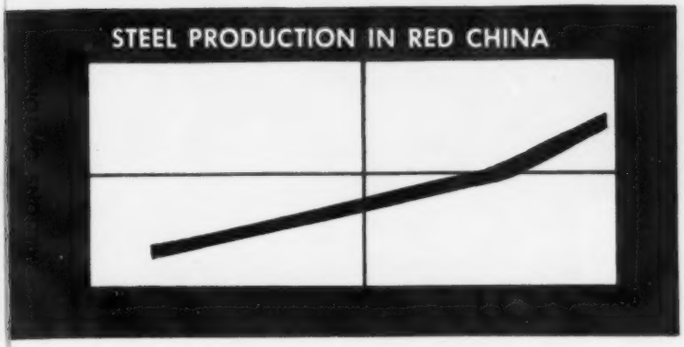
"The challenge also warrants an equivalent effort by our economically advanced allies. Their growing political and economic strength warrants their assuming an increasing portion of their defense burdens and an expanding role in promoting the economic development of the less developed countries."

Nor must we overlook the threat—perhaps an even greater threat in the long-range future—posed by Communist China. The Korean War and the stalemate that ended it without victory, gave a clear foretaste of China's growing military strength.

"Six hundred million people controlled by dictatorship . . . could one day pose



a coldly calculating and ruthless problems far beyond the Soviet threat."



Six-hundred-million people controlled by a coldly calculating and ruthless dictatorship that is attempting rapid military and economic progress without counting the cost in terms of human misery, could one day pose problems far beyond the Soviet threat.

Perhaps for the first time in history China's teeming millions appear to be politically unified and trying under pressure to accomplish a century of economic development in a generation.

A year ago we heard much of the small garden-type steel furnaces which were suddenly to make of China a modern industrial nation. Later China's leaders admitted these claims were exaggerated. But steel making did go up faster than in any other nation and is still growing rapidly.

China's "Great Leap Forward"

Now we are told that one-hundred-million Chinese are helping to build the world's largest network of dams, irrigation canals and hydroelectric plants. This story also may not be wholly true, but given a little time, this unprecedented attempt to harness the great rivers of China could solve China's need for more millions of acres of irrigated land and for many times China's present resources of electric energy. This "great leap forward" is being spurred by a tremendous campaign of propaganda and hatred against the American foreign devils and accompanied by a steady military buildup which may spell trouble ahead.

Our people may be awakening to the need for a re-evaluation of our national objectives in today's divided world.

At least in the military field a great defense debate has begun, the outcome of which will most assuredly affect our national military posture. It seems clear that our strategy of deterrence by threat of massive retaliation, which gained such general acceptance when we enjoyed a virtual monopoly in the nuclear field, must be re-examined now that our monopoly no longer exists.

50 to 100 Million Casualties

An all-out nuclear exchange today, or certainly tomorrow, would mean mutual devastation so great as to approach mutual suicide. Educated guesses for such a disaster run to 50 or even to 100 million possible casualties. Obviously our future military strategy should not depend on the threat of nuclear retaliation against local or limited aggression.

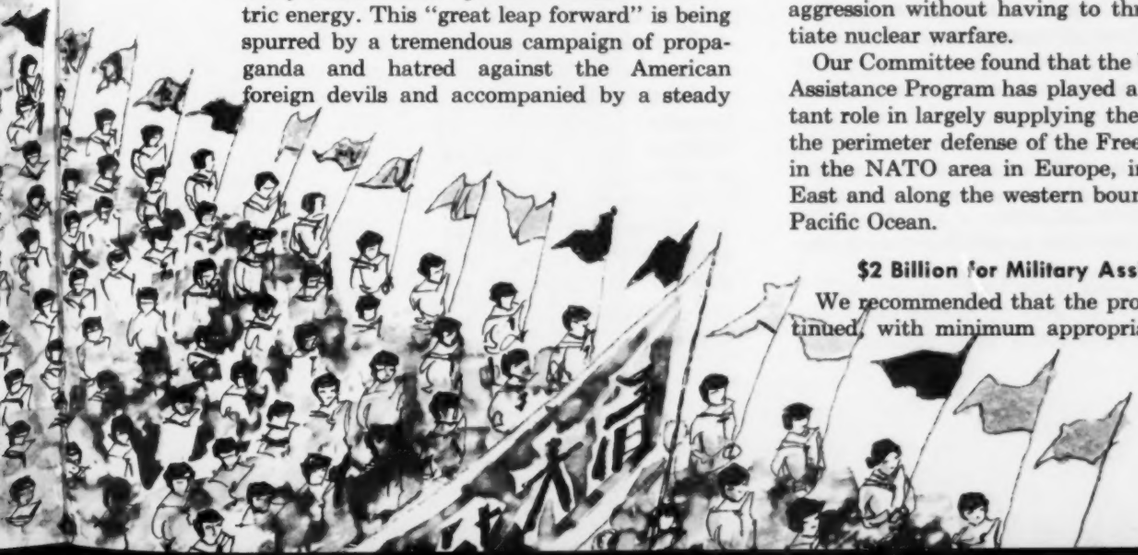
And for our nuclear deterrent to continue to be credible—and therefore effective, even in countering the possibility of all-out aggression —we must be sure, and any potential enemy must be convinced, that after absorbing an all-out first-strike nuclear surprise attack, we have the capacity to strike back and destroy any potential aggressor. Our second strike capability, now and for the foreseeable future, must be sufficient, and amply sufficient, to wipe out both the enemy's war-making power and its national industrial strength.

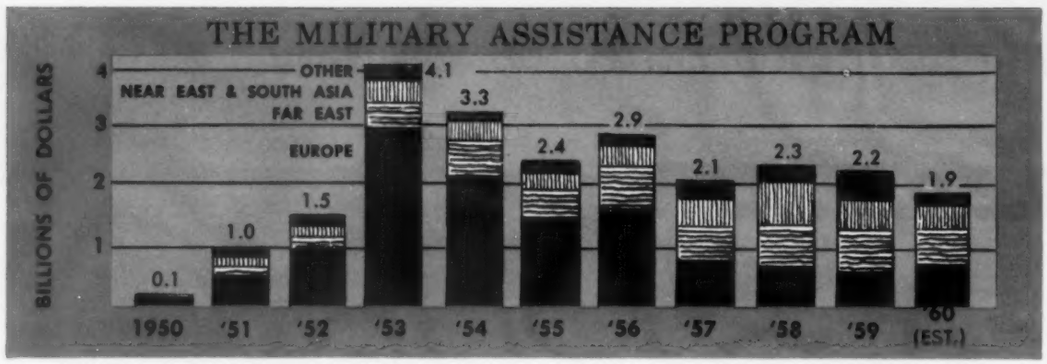
It seems equally clear in this atomic age, when nuclear retaliation would involve so great a cost in mutual destruction, that we and our allies must have sufficient strength in conventional weapons to successfully hold the long boundary between the Free and the Communist worlds. We and our friends and allies must be able at all times to fend off local aggression without having to threaten or initiate nuclear warfare.

Our Committee found that the U.S. Military Assistance Program has played a most important role in largely supplying the weapons for the perimeter defense of the Free World, both in the NATO area in Europe, in the Middle East and along the western boundaries of the Pacific Ocean.

$2 Billion for Military Assistance

We recommended that the program be continued, with minimum appropriations of two





Source: Mutual Security Program Summary, Mar. 1960

"... we must set the pace if we actually intend to win the over-all competition..."

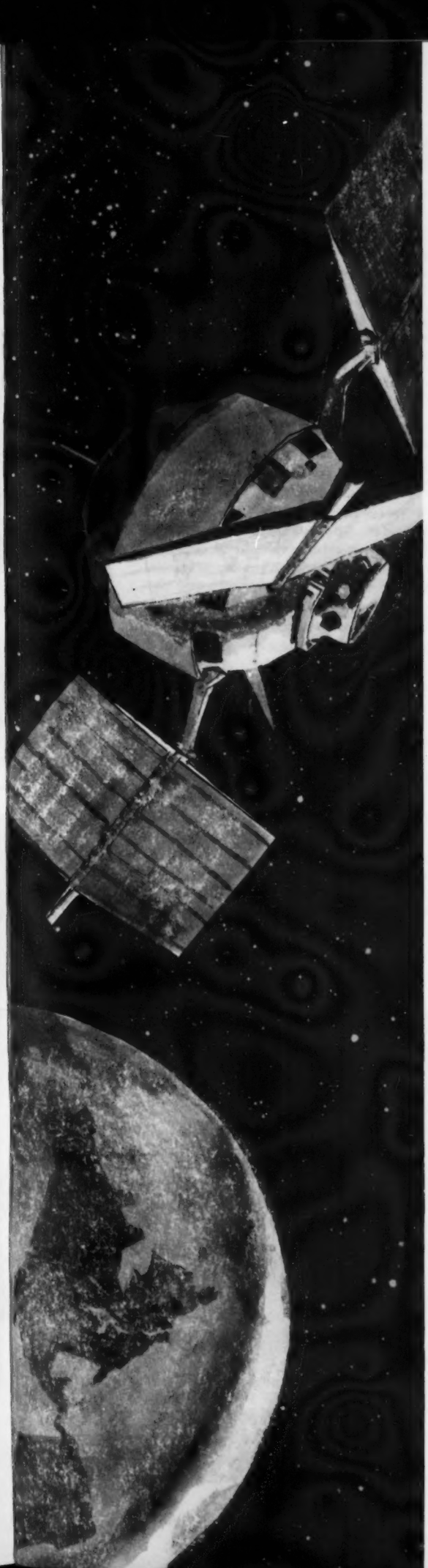
billion dollars each year, that these appropriations be transferred to the Department of Defense as part of our own defense costs, and that a Director of Military Assistance be appointed to assure better long-term planning and better day-to-day administration.

All of these recommendations have been accepted by the Administration. The Congress agreed that military assistance appropriations should be requested and administered by the Defense Department, and is now considering President Eisenhower's 1961 fiscal year request for two billion dollars for military assistance, and for comparable appropriations in the equally important economic assistance field.

But even if Congress grants these mutual security requests in full, and even though our industrialized allies step up their own appropriations for defense and for economic aid to the underdeveloped countries, as several are already doing, we in the United States must still come to a basic decision. As the leader of the Free World we must set the pace if we actually intend to win the over-all competition to which the Soviet leadership has challenged us.

We can overcome the Soviet threat—and the future threat from China too—if we want to do so badly enough as a nation. But we must be willing to sacrifice more, to shift emphasis in using our resources, to work longer hours, to pay more taxes, to give up luxuries, all as necessary to hold the lead in defense, in space exploration, in scientific achievement and in the education of our children. Only with this national resolution can we accomplish what is necessary and still balance our internal and external national budgets and maintain a sound economy.

We—the American people—must decide our primary national objective. Do we want continually greater material comforts and so risk our future, or will we accept less luxury and more surely preserve our American heritage?



U. S. Technological Progress–

Where We Stand

by Dr. Herbert F. York, Director of Defense Research and Engineering, Department of Defense

Scientific advancement has been recognized as one of the greatest Soviet propaganda weapons being directed toward lesser-developed countries. The man who has the power of decision over many U.S. top weapons development programs takes a broad look at our position, relates it to economic well-being, and sets a challenge to the government-industry-science team.

Please put in over-all perspective: U.S. technological progress (both military and non-military) as it relates both to national security and to national economic well-being.

The technological progress underlying both the national security and the national economic well-being depends on the same resources in skilled persons and institutions for scientific research.

What has been the increased importance of U.S. technological progress during the past 20 years, as indicated by the increasing degree of support it has been given (in dollars or other measurements)?

The last hundred years have seen an ever-increasing tempo of U.S. technological progress. Initially great gains were made through

The position of Director of Defense Research and Engineering has been described by Neil H. McElroy, former Secretary of Defense, as a post which has "centered in one man the initial responsibility to determine at a very early stage which (defense) projects should be pursued and at what rate of spending" (*DEFENSE QUARTERLY*, Jan.-March, 1960, p. 13).

Dr. Herbert F. York's extensive background for this Presidential appointment includes: Phi Beta Kappa scholar, former University of California physics professor and Radiation Laboratory director, a pioneer in atomic and radiation research, a major contributor to varied research programs of the Atomic Energy Program, scientific advisor to numerous top government and military committees, including the Air Force and Army Scientific Advisory Boards and the President's Science Advisory Committee.

"We must employ our . . .

simple experimentation and empiricism. Since the turn of the century the basis has shifted almost completely to dependence on scientific research, theoretical analysis and complex experimentation to verify analysis. The increase in tempo is illustrated by comparison of the estimated $345 million total spent in the U.S. for research and development in 1940 with the more than $12½ billion to be spent in 1960.

Has the U.S. rate of progress lagged behind, kept pace with or exceeded this increasing degree of support?

The large growth has been accompanied by an increased complexity or "degree of sophistication." In many fields, interdisciplinary teams and expensive equipments are now needed to produce significant results. Sometimes it appears that a proportional increase in progress does not result from increased support. However, it is so difficult to measure progress in an objective sense, that we cannot really state whether or not progress has kept pace with the increased support.

It is often stated that the Communist bloc is exploiting science as a weapon in the cold war, to prove the superiority of their system and thereby win respect (and converts) from the uncommitted nations:

- **a. Do you agree with this thesis?**
- **b. If so, how well is the U.S. doing—and how well can it be expected to do—competitively with the Communist powers?**

There is no doubt that the scientific accomplishments of the Soviet Union and, in fact, their improvements in all fields since the Tzars, are used by the Soviets in their aggressive propaganda approach to less developed areas of the world. Actually, the traditional U.S. image in the eyes of the rest of the world has, in part, the same foundation of our significant material accomplishments. In addition, however, I believe strongly that the respect for the U.S. is based on more than material things; namely, on our concepts of freedom.

It is also frequently stated that technological progress benefits all programs, regardless of where any specific achievement may have had its origin —that R&D breakthroughs originating in commercial fields bring direct benefits to the military, and vice versa:

- **a. Do you agree?**
- **b. If so, please illustrate.**
- **c. What more can be done to realize maximum value from all U.S. (and world) scientific progress?**

It appears to be axiomatic in the history of technology that scientific breakthroughs are of greater value in the long run in fields of application different from those originally intended or visualized. While one would not advocate an increased expenditure in military research and development solely on the basis of the commercial spin-off benefits, the value of these benefits in the long run to the whole country and its economic well-being should never be overlooked. There are many examples

Many military sponsored developments provide commercial benefits, such as the aircraft, engines and radar that make possible today's jet travel.

continually . . . improve our procedures . . . and . . . resources in a manner that avoids their waste . . ."

of items initially developed under military sponsorship which found widespread commercial application. At the very start of our national government, Eli Whitney developed the technique of interchangeable parts for the production of muskets. This technique was soon applied to civilian industry. At about the same time, Nicolas Appert developed the process of packing heat-sterilized food in a hermetically sealed container to win a Napoleonic prize offered because of military needs. The fixation of atmospheric nitrogen, penicillin, synthetic rubber, the airplane, radar, electronic computers and countless other major achievements have had peaceful benefits more or less directly resulting from the military stimulation.

Much discussion has been focused on: can the free enterprise system (as employed by the U.S.) prove superior to the state-control system (as exploited by the Communists). In view of our dependence on the government-industry-science team, what more can be done to increase the efficiency and output of these team members?

There are many avenues we can pursue to increase the efficiency and the output of these team members in the long run. Most of these have been identified and discussed from time to time. We must work at the bedrock of the structure in strengthening our educational programs and providing for the support of basic research and its evermore costly equipment and facilities. We must work at the problem of indexing and retrieving scientific information and distributing it to those who may be able to apply it. We must continually revise and improve our procedures in contracting, cost allowance, utilization of technical manpower, and in many other operating aspects so that we continue to utilize the great motivating influence of the free enterprise system and, at the same time, employ our technological resources in a manner that avoids their waste and duplication in meeting our over-all national goals.

Wide World

Respect for the U.S. is based on more than material things; namely on our concepts of freedom. Above, immigrants are processed for U.S. entry.

Source: Industrial College of the Armed Forces

Industry's Role–

by George F. Metcalf, Regional Vice President,

Just before his present assignment, George F. Metcalf directed General Electric work on 13 major missile projects, including the Air Force's Atlas and Thor and the Navy's Polaris. He was General Manager of the Company's Missile and Ordnance Systems Department.

With General Electric since graduation from Purdue with an electrical engineering degree in 1928, Mr. Metcalf was instrumental in the early development of electronic tubes, radio and specialized radar equipment. Positions include Manager of the Electronics Laboratory, General Manager of the Electronic's Specialty Department, and General Manager of the Special Defense Projects Department. A World War II colonel, Mr. Metcalf holds the Legion of Merit and Order of the British Empire for wartime radar work. He has served on the National Defense Research Committee and the Air Force Scientific Advisory Council.

Now located in Washington, D.C., he applies more than 30 years technological and defense experience in relating industrial management to national requirements.

Pin-point accuracy . . . split-second timing . . . yet flexibility for constant change. These are bywords of today's and tomorrow's aerospace age. We have come to accept these qualities as fundamental and expect them of the men who control our supersonic aircraft and hypersonic missiles.

What about the men of industry—the team called upon to produce these modern-day miracles? Here, the need is no less critical than at the launching platform—in many respects *more* critical. To maintain Free World leadership, our management must develop the *pin-point accuracy* to predict product demands 10 to 15 years ahead, the *split-second timing* to bring the right product in on schedule, and constant *flexibility* to keep pace with the explosive growth of technology.

It is indeed a challenge to U.S. industry and management. What must American industry do to manage its resources effectively in the face of even faster weapons obsolescence, swiftly moving political events, and an exploding Soviet economic advancement? *What is industry's role in managing our nation's total resources for defense and prosperity?*

What Are Industry's Resources?

First of all, what are the resources at industry's disposal? Certainly, they are more than the buildings, plant equipment, materials, and tools that first come to many people's minds. Most important, industry's resources include the priceless combination of creative managers, the engineers, the scientists, the skilled workmen, the many specialists, who contribute to our total national defense, or to our economic welfare.

Whatever the national and military policy, the businessman must help to implement it through creative management of America's industrial resources. A top management contributor to a number of current major U.S. missile programs, Mr. Metcalf pinpoints problem areas, calls for—and gives case examples of—long-range technical planning into the 1970's.

and the Need for Flexibility

General Electric Company

It is the output of these people which we must manage effectively. And here the resource of scund organization is vital. Good men can triumph over poor organization, but good organization can contribute immeasurably to the flexibility, creativity and productivity of any group.

The *resources management* job is a complex procedure which must ever change to meet new demands. Flexibility is the keynote. As one example, look at the widely fluctuating demand on industrial resources during the past 20 years, as reflected by recent Department of Commerce and Department of Defense statistics.* In 1940, just before World War II, less than 3 percent of industry's output—products and equipment—was involved in defense work. The other 97 percent was building refrigerators, automobiles, radios, and the increased flow of other consumer goods required to meet public demands following the depression.

Suddenly we were in World War II when the ratio averaged 87 to 13 percent in favor of defense activity. Then came peace, and from 1947 through 1950 the pendulum had swung to a 5 to 95 percent ratio, this time in favor of nondefense work. Then Korea, when 24 percent of our nation's output was the weapons of the jet age.

Two jolts were enough; the Cold War was solidly with us; and in the past five or six years, defense effort has leveled out to 15 percent defense to 85 percent nondefense. But compounding the problem is the fact that defense-peacetime conversions are much more difficult today than ever before. Dr. Peter F. Drucker, Management Consultant, points out that, "today something like 90 percent of the material needs of defense consist of special-purpose equipment, which cannot be produced except in specialized facilities, built for that purpose and usable for very little else." (*Defense Quarterly*, Jan.—Mar. 1959, page 4.)

*Percentage comparisons are developed from expenditures for defense hard goods, as compared to the durable goods producers portion of the Gross National Product.

Defense Budget Fluctuations

Even under the present 40-odd billion dollar plateau of defense expenditures, there can be wide fluctuations which demand the highest degree of flexibility on the part of individual industries. Why these fluctuations? The exponential growth of human knowledge and understanding of natural resources leads to weapons of ever-shorter life span, but of far greater effectiveness. New ones therefore must be conceived, developed, manufactured, and supplied to trained forces at an ever-increasing pace.

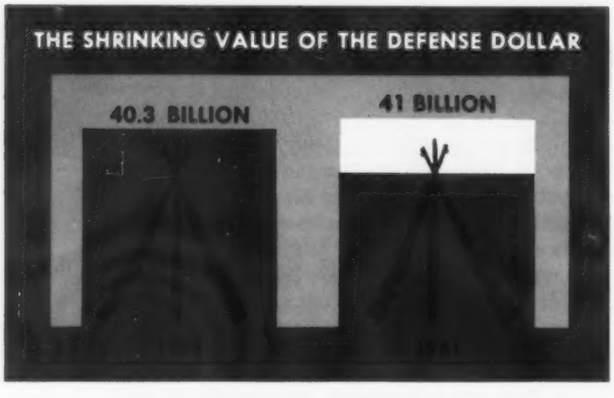
More and more it is industrial capacity for innovation—not for World War II type production—that is the key to modern defense. Our government recognizes this by actively supporting technological advancement, at an increasing rate. National Science Foundation figures show that 61 percent of all research and development effort in America was government sponsored in 1958, compared to 53 percent in 1954, and a percent or so in 1940. Currently, approximately 83 percent of Federal Government expenditures for R&D effort is directed toward defense. However, there are and will be many nondefense by-products, such as commercial air transport, nuclear power generation and space studies.

"Basically, the solution lies in management principles which al

A recent editorial in *Science* magazine points up that our government's planned research and development budget for fiscal 1961 has increased approximately a hundredfold since 1940. Not since 1948 has the national research budget amount been smaller than it was in the year before. This is not due just to bureaucratic or "pork barrel" spending but to the fact that science and technology are playing a major part, and an increasing one, in the lives of all of us.

Defense Spending May Be Decreasing

Despite increased R&D effort, that part of our federal budget concerned with national security may well be decreasing even though the dollar figure has been increasing. Writing recently in *Newsweek*, General Carl Spaatz (Retired), former Air Force Chief of Staff, points out that actually "we have been cutting our defense expenditures every year since 1953, even though we may seem to have been increasing them recently." According to General Spaatz, "military spending in the first full fiscal



year of the current Administration amounted to $40.3 billion. Because the buying power of the defense dollar has shrunk so much since then, we would have to spend close to $50 billion in the next fiscal year (1961) to hold to the level of fiscal year 1954 outlays. So the budget for the next year will have the effect of reducing defense expenditures almost $10 billion below those of seven years ago."

The effects of sharp fluctuations, budget squeezes and abrupt contract cancellations cannot—should not—be minimized. They can work hardships on the military, on large and small business, on the community, on the taxpayer. Such swift changes can be reduced in number and in size only through full understanding of the causes. Then creative management can lessen their effects on all.

For example, just this past year at General Electric's jet engine plant in Cincinnati, Ohio, we were faced with a year of disappointing cutbacks and cancellations in weapon systems using our engines: the B-58, F-108, B-70. But management planning for product growth, versatility, diversification, innovation, is proving its worth. A significant number of new military aircraft planned for procurement have our engines. To further bridge the production gap, Flight Propulsion Division management has directed studies toward industrial and marine use of gas turbines. The line of engines for American and foreign commercial jetliners is being expanded, and other areas are being explored for future business: rockets, vertical and short takeoff-and-landing applications, hypersonic engines and space propulsion. But this is just one example from one company of temporarily reducing the effects of the defense business fluctuations. How can industry as a whole meet future demands for flexibility?

The Solution: Proved Management Principles

There is no single, ready-made answer, of course. Basically, the solution lies in applying, creatively and across a broader base, management principles which already have proved successful in civilian industry.

To meet the challenge with limited industrial resources, we must compete on *our* terms using *our* principles. These principles may be stated many ways; within General Electric, we identify (and use) basically four: planning, organizing, integrating and measuring. We teach them in formal management courses to all of our professional management personnel, and we promote our people on how well they execute them. These principles, while interrelated and interdependent, are often applied simultaneously rather than in sequence. We believe that they are appropriate to all phases of industrial management, defense and nondefense.

1. Planning Leads to Product Innovation

In contrast to the Soviet's centralized planning with relatively few centers of initiative, the U.S. has many thousands of centers of initiative and responsibility—government and industry—aimed at developing the products of the future, both military and nonmilitary. Increasingly, U.S. private-enterprise companies are beginning to propose to the government

in applying, creatively . . .

already have proved successful . . ."

the products and technologies that they can create, without waiting for the military planners to tell them what is needed. This organized planning speeds up the developmental process, makes it more accurate, leads to product innovation—all of which are so necessary for modern military and economic superiority. It also creates new markets, greater ability to serve, more jobs. In General Electric, for example, this approach has resulted in one third of our employees working on products today which were no more than the visions of our most starry-eyed inventors just 20 years ago—such things as television, 2000-mile radar, space vehicles, commercial atomic power. It seems that no matter how visionary we may try to be, we always underestimate the power of creative people. General Electric's answer to this has been the establishment of a number of laboratories and planning centers staffed by trained scientists and engineers and located in environments that challenge their staffs to look ahead.

One of the General Electric's most dramatic "centers of creative planning" is a long-range planning group located at Santa Barbara, California, and organized within the Company's Defense Systems Department. Aimed at not only forecasting, but in fact accelerating, weapons obsolescence, this Technical Military Planning Operation (TEMPO) is our military "think" factory. Here we have physicists, economists, psychologists, scientists and experienced military strategists contributing to the country's posture and future in defense—predicting military requirements well into the 1970's.

What have been the benefits thus far of this kind of planning? Obviously, even the titles of many of the studies are security classified; but TEMPO has presented numerous studies to the government. A recent one involved military strategy, equipment demand, and equipment supply as related to U.S. Air Defense requirements from 1965 to 1970. Another study scheduled for completion by the end of 1960 is aimed at outlining effective continental defense against missile-launching enemy submarines. Just recently, TEMPO has proposed to the Air Force a study aimed at outlining the most effective use of ICBM weapons in the 1965 to 1970 period.

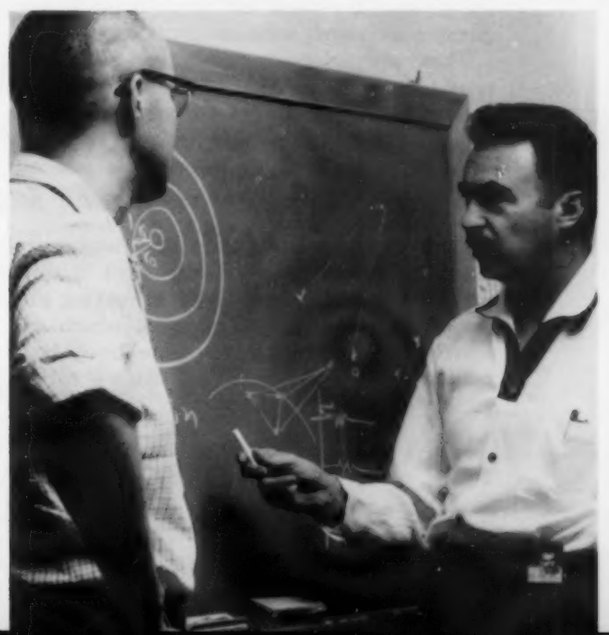
2. Decentralized Organization Pays Dividends

At least for General Electric, decentralization has been the key to organizing for swift decisions, flexibility and innovation. The philosophy is to organize so that authority to make decisions—and better ones—is placed at points as near as possible to where actions take place. Historically in our industrial economic system, when this has been done—when organizational responsibility has been clear—success has followed. And when this principle has been applied to the military, we have seen comparable success, notably through the single project-manager concept.

Our nation's Ballistic Missile Programs are in themselves dramatic examples of how national and industry planning and organizing can telescope the time periods previously involved in developing complex military systems.

The Technical Military Planning Operation, a long-range planning group, is one of General Electric's "centers of creative planning."

At TEMPO, physicists, economists, psychologists, scientists and military strategists predict military requirements into the 1970's.



GENERAL ELECTRIC

I believe that you, as a reader of the DEFENSE QUARTERLY, will be interested in receiving the text of a lecture recently delivered by Mr. Cordiner at the University of California, Los Angeles.

One noteworthy feature of this address is the analogy it draws between the opening up of past frontiers and the present problems and opportunities of the explorations and economic development of space.

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COMPETITIVE PRIVATE ENTERPRISE IN SPACE

Lecture V—"Peacetime Uses of Space" Series

Royce Hall, University of California

Los Angeles, California

May 4, 1960

GENERAL ELECTRIC

Competitive Private Enterprise In Space

RALPH J. CORDINER
Chairman of the Board
General Electric Company

THERE are two basic forms of human organization: the free societies, such as the United States; and the regimented societies, such as the Soviet Union. In free societies, the government is the servant of the people. In regimented societies, the people are the servants of the government.

No society is completely free or completely regimented, but the distinction is real, and it is profoundly important to the quality of human life. The two systems are now engaged in a protracted struggle for the future of the world. They are competing in every field of human endeavor, including the field of economic development.

A distinguishing feature of the free societies, as opposed to communist and other socialist systems, is the use of competitive private enterprise as the primary means of economic development. The citizens of the United States have both philosophical and practical reasons for preferring business enterprise to government enterprise. Philosophically, the competitive private-enterprise approach is more appropriate to a free society than government-owned or government-controlled industry, which is one of the characteristic features of a regimented society. And practically speaking, the system of competitive private enterprise has enabled this country to produce a level of living that is unmatched anywhere, anytime.

Even the rulers of Russia and China cannot think of a more effective incentive for their regimented people than the hope that someday they may attain the standards of the people of the United States. Communism and socialism may claim to be the revolutionary systems of our times, but for almost every human being outside the Free World, the most successful imaginable revolution would be one that would enable him to live like the average United States citizen.

SPACE RAISES QUESTIONS

Now, the two contending systems are beginning to compete in a new area: in the exploration and economic development of space. This will be a vast and expensive undertaking, and it poses some fundamental questions for the citizens of the United States.

How can we utilize our dynamic system of competitive private enterprise in space, as on earth, to make newly discovered resources useful to man?

How can private enterprise and private capital make their maximum contribution? What projects will necessarily require government chairmanship and support for their execution?

What must be done to preserve a free society while competing in an international race for space? How can we assure that when the space frontier is developed, it will be an area of freedom rather than regimentation?

My assignment in this series of lectures is to discuss some of these questions. Specifically, here is my objective:

First, I will submit for your consideration some deeply important impacts of the space challenge on this country's free society and its system of competitive private enterprise. Many will be highly beneficial. Others have chilling implications. And some are ambiguous at present. All of them will affect the life of the individual citizen and his children, and are therefore worthy of his informed interest and concern.

Next, we will examine some of the underlying principles of the United States political and economic system—principles that must be recognized in the formulation of national space policy.

On this basis of principles, I will then suggest the specific roles of industry and government in the exploration and economic development of space.

Then finally, I will suggest some changes in the legal framework that would encourage the maximum contribution of competitive private enterprise.

Let us begin by looking at the future impact of space activities on the free society and private enterprise.

There will be many effects that are primarily beneficial.

A NEW FRONTIER

The advanced industrial nations can now send objects off the planet into space. This new capability opens a whole new frontier to human exploration, development, and use. At this stage, the new frontier does not look very promising to the profit-minded businessman, or to the tax-minded citizen. But then, so it must have seemed to the Greeks, when Jason returned from his exploratory trip into the Black Sea; or to the Phoenicians, when their first explorers returned from the wild and savage shores of the Western Mediterranean. Most of the Greek and Phoenician traders, in 1000 B.C., probably preferred to invest their money in a good safe cargo of grain or wine, shipped over familiar sea lanes to familiar markets. But apparently a few traders, and later colonists, had the vision to see possibilities where other men saw nothing, because in a few centuries the Black Sea and the Western Mediterranean became familiar and profitable regions, enlarging the resources available to civilized man.

Every new frontier presents the same problem of vision and risk. According to Herodotus, the Pharaoh Necho of Egypt sent a crew sailing around the continent of Africa about 600 B.C. If Egypt had followed through with further exploration and economic development, Africa today might be a highly developed continent. But the vision was lacking, and no civilized man again saw South Africa for 2,000 years. Leif Ericson discovered America 500 years before Columbus, but apparently the Vikings did not have the vision to see anything worthwhile on that vast, empty continent, and so history waited for another half millenium.

Even our own Western frontier seemed so unpromising just 157 years ago that the Emperor Napoleon, hard pressed for money, sold all the land from the Mississippi River to the Continental Divide to the young United States for only $23,000,000, including interest. With that one purchase of the

unknown Louisiana Territory, President Jefferson doubled the size of the United States and changed the course of history. Thomas Jefferson did not know what he bought, but he sent Lewis and Clark to find out, and private traders, homesteaders, and businessmen followed in their path to turn the empty wilderness into the heartland of a great nation.

Even in our own time, we have had prominent men who stated that airplanes would never fly faster than sound, that intercontinental missiles could not be developed, and that space flight is nothing more than a comic-strip fantasy.

I am reciting this ancient and recent history to be sure that we have the right perspective. When a new frontier is opened, the new territory always looks vast, empty, hostile, and unrewarding. It is always dangerous to go there, and almost impossible to live there in loneliness and peril. The technological capacities of the time are always taxed to the utmost in dealing with the new environment. The explorations require huge investments of both public and private funds, and the returns are always hazardous at first. A few enterprises succeed fabulously, but many fail through inadequate planning or bad timing. The organization, capital, and equipment required for the first exploratory efforts are so large that people tend at first to think only in terms of governmental and military action; and only later do they conceive the new territory as simply an extension of their present territory and their present economy.

It takes an immense effort of imagination for the citizens to see beyond these initial difficulties of opening a new frontier. No one would pretend to foresee all the economic, political, social, and cultural changes that will follow in the wake of the first exploratory shots into space, any more than the people in the days of Columbus could foresee the Twentieth Century world. But such an effort at prophetic imagination is what is required of us as citizens, so that we will not, like Leif Ericson, leave the making of the future to others.

The most important long-term impact of the new space capabilities, therefore, is that they open up a new frontier for exploration and economic development. From the businessman's viewpoint, this spells risk and opportunity. But there will be other effects on the nation's business life.

ACCELERATING TECHNICAL PROGRESS

The effort to explore space, and to keep from falling behind other nations in this area, will accelerate the progress of many present-day industrial technologies. The discoveries made in the race for space will have many applications outside the space program. At the same time we must remember that the space technologies are not being made out of whole cloth; they are for the most part extensions of industrial technologies developed for commercial and military purposes.

Electronics, for example, is a technology that has been under constant development and use for four or five decades; but the needs of the space program have put extra pressure on the drive for miniaturization. This will be valuable in such important commercial fields as communications, data processing, automation, and even home appliances.

The space program will also help to accelerate the development of new or unusual power sources, such as the fuel cell, thermionic converters, the MHD (magnetohydrodynamic) process, and vastly improved nuclear power sources. It will undoubtedly help to overcome some of the limitations in materials that are now hindering progress in many industries, by forcing the development of high-temperature, high-strength materials.

The work on rocket engines is bringing in new knowledge about chemistry and combustion. Cryogenics, the study of what happens to matter and energy under conditions of extreme cold, will unquestionably move more rapidly because of the space program. Medical and biological research are being accelerated by the need to know how to sustain life in the airless, weightless, cold, and hostile conditions of space. This listing of the various technologies that will benefit from the space effort could go on for a long time. But the examples I have cited show that many early and practical gains will be made by putting to work in industry the knowledge gained in space-oriented research.

In Philadelphia, General Electric conducts two different businesses. One of them is the development and production of switchgear for the electric utilities and industrial customers. The other is the Missile and Space Vehicle Department. The two would seem to be unrelated, but in some instances they are mutually supporting operations. In the Switchgear Laboratory we have costly special facilities for producing very large electric arcs. The Missile and Space Vehicle Department arranged to use this same equipment to generate the plasma conditions that are necessary to test nose cones and other re-entry vehicles. In the course of their work on re-entry vehicles, the scientists of the Missile and Space Vehicle Department have come up with some rather unorthodox approaches to the control and use of arc phenomena—which is at the very heart of electric power control technology. Thus space research and industrial research mutually support each other.

IMPACT ON BUSINESS THINKING

Another beneficial impact of the space adventure will be its impact on the habits of thought in business and elsewhere. It will encourage bold, systematic planning of a long-range nature by forcing men to envision the means of coping with a completely new and hostile environment. It will likewise force long-range speculation and planning in the political, economic military, technological, and social areas to anticipate future applications and effects of space technologies. Already we are seeing the growth of novel planning organizations made up of physical and social scientists, engineers, financial experts, and professional managers. Their whole output consists of ideas, forecasts, and evaluations of future possibilities. Such planning organizations are already in being in other companies besides General Electric.

The space frontier will inevitably increase the scale of thinking and risk-taking by business. When we are dealing with space, we are dealing with a technology that requires a planetary scale to stage it; decades of time to develop it; and much bigger investments to get across the threshold of economic return than is customary in business today. Business must now think in international terms, and in terms of the next business generation. It must step up to the big risks with the same vision that enabled an earlier generation of builders to push railroad tracks out across the wilderness and lay the foundations of our modern economy.

Another beneficial impact of the space adventure, already visible, is that it is encouraging the creation of more businesses of all sizes. To those who insist that small business is declining, I only ask that you leaf through the advertisements in the technical magazines to see how many thousands of new businesses have sprung up to handle the requirements of modern technology. Most of them are suppliers of specialty equipment for the larger concerns that have responsibility for major components and systems. For, in addition to more small businesses, the space adventure also creates the need for much larger enterprises than are in existence today, with financial and technical resources commensurate with the tasks ahead.

Unquestionably, this need for much bigger companies and groups of companies will run head-on into the prejudice of those who cherish an irrational suspicion of any business larger than a family grocery store. But such prejudice will not survive very long in the Space Age. The space challenge will, in fact, force government and business to re-assess their relationships, in view of their inevitable partnership in a lengthy enterprise. This is good, because it will force us to face the need for new relationships in a new world.

Thus far I have dwelt on the effects that will be primarily beneficial. But the venture into space has its negative side, too, and all of us as citizens should be aware of it.

A DANGER: GOVERNMENT DOMINATION OF INDUSTRY

It appears that the exploration of space is going to depend, for many years, primarily on government financing and hence government direction and control. That will be true because the exploration of space offers relatively little commercial opportunity for private business, in the years immediately ahead.

If the space effort were only a minor activity, the dependence on government financing and control would have less economic impact. But the fact is that the military and peaceful needs of the space program are already employing a significant percentage of the industrial work force, and will make up an even larger proportion of total employment and production of the country as the years go by. The aircraft industry, for example, is broadening its scope to include missile and space technologies. Much of the electronics industry is devoted to missile and space needs. The communications, chemical, and metallurgical industries are increasingly involved. These industries are already among the largest employers in the United States, and they are the major employers of the nation's technical manpower. Hence we are not speaking of a minor element in the national economy, but of its leading growth industries. These industries are subject to ever-increasing government influence by way of government contracts. And the Space Age is only beginning.

Research and development are also drifting under government control. For reasons of defense and space exploration, the federal government has become the nation's primary sponsor of research and development in practically all of the new technologies. The area of independent research and development by private industry and private universities is becoming proportionately smaller. This means that the pace and direction of progress in most of the leading technologies are substantially under the control of government agencies.

The situation is made worse by the fact that, under the National Space Act, any inventions first applied in connection with a federal space project, regardless of how they were developed, automatically become the exclusive property of the government. This greatly reduces the incentive for the company that made the invention to develop it for the benefit of consumers and industrial customers. It does not take a prophet to see the long-term effect of this situation on the future independence of the universities and the future vitality of private enterprise.

The patent provisions of the National Space Act are based on the unusual patent provisions of the Atomic Energy Act. But it is important to realize the vast difference between the development and production of nuclear material and that involved in the exploration of space. The development of nuclear material is a relatively clearly defined, closely integrated area of technology. On the other hand, space exploration involves the utilization of nearly every field of science and technology known to man. In the case of atomic energy it has been possible to erect certain reasonable boundaries around the government's research and development activities, while in the area of the so-called space sciences this is totally impossible. It is the confusion of these two types of technologies which has led to the National Aeronautics and Space Administration Patent Clause which is so unworkable and poses such a threat to the independence of private enterprise.

GOVERNMENT FACILITIES EXPANDING

An even more disturbing effect of the growth of government-sponsored research and development is the temptation for the federal government to build its own facilities and personnel in the technical fields, or to establish so-called non-profit organizations which are totally dependent on government contracts. However generous their motives, these non-profit organizations are usurping a field traditionally served by private consulting firms and producer companies, and hence are little more than a blind for nationalized industry competing directly with private enterprise—on a subsidized, non-tax-paying basis. Since the space effort

will, for a long time, be primarily a research and development effort, this tendency could lead to an unexpected, and perhaps undesirable, build-up of government-controlled facilities. Looking to the future, when the space frontier has been explored and is ready for economic development, we might well find the area pre-empted by the government, which would then have most of the personnel and facilities available. This would leave the nation almost no choice except to settle for nationalized industry in space.

Please understand me. I am not saying that the people who work in government arsenals and laboratories or non-profit organizations are any less competent or dedicated than those who work in private industry. I am not saying that government laboratories should be dismantled, because many of them serve a useful function. The government needs a certain number of experienced technical men to help make realistic choices as to future missions, to set high standards of performance, and to provide technically sound policy guidance. That cannot be done by men who are not actively engaged in space research and development. Hence a certain percentage—perhaps as much as 5 per cent—of the technical work of the space program is best done in government laboratories. They should be well staffed and well financed.

But we must recognize that there are growth tendencies in these government agencies that could overexpand under the pressures of the space program, unless proper safeguards are established. As we step up our activities on the space frontier, many companies, universities, and individual citizens will become increasingly dependent on the political whims and necessities of the federal government. And if that drift continues without check, the United States may find itself becoming the very kind of society that it is struggling against—a regimented society whose people and institutions are dominated by a central government.

To some of you, and perhaps most of you, this may appear to be an alarmist position. In my preparations for this lecture, I was surprised to learn how many people have simply taken for granted that space is a natural domain of the government. Almost no one had looked forward to the time when space has been explored, to ask whether its development shall be under our traditional competitive enterprise system, or whether—unlike the rest of the economy—space shall be pre-empted for government enterprise. And practically no one saw the relationship of these assumptions to the world struggle between free societies and those that are government-controlled.

PRINCIPLES OF A FREE SOCIETY

It is important, as we undertake this long and expensive race into space, that we as citizens bear in mind the kind of society we wish to maintain and develop. As I stated at the beginning of this lecture, we in the United States have a political and economic system that, in spite of its imperfections, is the most productive and admired system in the world. It not only preserves, but utilizes human freedom as the key to social and economic progress. We want to maintain this free society in a world where many factors are pushing the nations toward statist systems.

One of the basic principles of the American system is the principle of decentralized power. This country has what is known as a "pluralistic society." There is not just one basic source of initiative and decision here, as in the government-controlled societies. Rather, in the United States, there are many competing points of initiative, risk, and decision—and that is the secret of this nation's drive and creativity.

There are millions of private institutions—colleges, churches, business firms, and associations of all kinds—who do not report to a common center of decision, but operate independently and competitively, trying to excel in their own limited areas of interest. In the government area, there are many governmental units at state and local levels that do not report in a chain of command up to the federal executive, but rather have their own limited areas of authority. Even our national government is a government of limited constitutional powers, which, for further protection of the individual, is divided into separate executive, legislative, and judicial branches.

And in our society, final authority for nearly all decisions rests with the individual citizens. Through the political system, citizens elect and remove their government representatives. Through the market system, individuals make personal economic decisions as to what to buy, where to work, how much to save, and where to invest. By this intricate system of decentralized personal decisions, the people direct—with a precision that no centralized system could ever hope to match—the course of the economy, the allocation of resources, and the character of national life in accordance with their own personal wishes. The people, not some self-selected government elite, decide the course of the nation. This decentralization of power is the strength of the free society, and it must be preserved.

THE COMPETITIVE SYSTEM

In the economic sphere, the principle of decentralized power expresses itself in the system of competitive private enterprise, operating in a basically free market. The competitive system offers many advantages that are not available to centrally controlled economies—and these advantages should be utilized in the space effort and the defense program, as well as the rest of the economy.

The competitive system, with its profit-and-loss disciplines, puts men and companies to the test as no other system does. It rewards the creative and the efficient. It penalizes the unimaginative and the inefficient. It provides an incentive for risk not only on the obvious ideas, but also on the "long shots." It provides a natural and effective system for the elimination of failure, complacency, and delay. At its best, the competitive economy has a vigor, diversity, creativity, and efficiency that no controlled economy can match.

What is the proper role of the government, in relation to the economy? Basically, it should provide an orderly political setting that encour-

ages individual initiative and competitive private enterprise. It should provide the regulation necessary to keep the economic system competitive—as it does through vigorous enforcement of anti-trust laws and other trade regulations. Government should do for the citizens, at their expense, only those things that the citizens cannot do for themselves through their private institutions. Thus, governments provide certain community services—locally, if possible; federally, if necessary.

National defense is necessarily one of the services provided by government, but in an age when military power depends less on standing armies than on technological maneuver, the role of private industry is vital. The exploration of space is a project that proceeds from a mixture of strategic motives, including military, political, economic, and ideological. It, like the national defense, will necessarily require a close partnership between the federal government and private industry. Each of these partners must perform its appropriate role, and the problems and delays occur where government tries to do the managerial and technical work for which industry is best qualified, or industry tries to take on the functions of government.

MEETING THE SOVIET CHALLENGE

The rapid progress of the Soviet Union in missile and space technology demonstrates how a controlled economy can ruthlessly concentrate major resources in a particular field of technology, and achieve rapid results—while neglecting other fields and keeping the population at a low level of living. Some have taken this to mean that the United States, in order to move out ahead of the Soviet Union in space technology, must adopt something like the Soviet method of strict government control of that technology. In my opinion, such an imitative procedure is doomed to fail.

The United States has its own more effective way of concentrating efficient effort on a technical project of importance to the national security. And that is for the people, through government, to determine the objectives to be attained, and then to turn most of the technical work of achieving those objectives over to the private firms that have the managerial and technical capacity to get the work done—using competition and profit-or-loss incentives to the maximum.

It has become the fashion, since the launching of the first sputniks, to exaggerate the Soviet achievements in space technology. Admittedly, the United States got off to a late start, particularly in the drive for high-thrust rockets. But once we were aroused to the potentialities of space, and recovered from the panic that produced the first series of propaganda failures, the true resources of the United States began to tell. The acceleration of the Atlas and Polaris programs astonished even ourselves, and showed that short lead times are not a Russian monopoly. The United States—even without high-thrust rockets—already has more scientific satellites in orbit, sending back more useful information, than the Soviet Union. When the national need is clear, the partnership of government and industry in the United States can work technical miracles.

But we have no reason to feel complacent. Our present system of defense and space activities still suffers from half-hearted incentives and excessive bureaucracy. This country can surpass the Soviet Union in any technology it selects—if it will use, rather than suppress, its basic strength.

Therefore, it is my view that national economic and military progress will be faster and more solid, and the freedoms we cherish will be preserved, if competitive private enterprise does just as much of the nation's scientific and technical work as possible—and government provides the legal and policy framework to stimulate outstanding technical performance.

THREE STAGES OF DEVELOPMENT ON THE SPACE FRONTIER

On the basis of these principles, let us now attempt to foresee the general outlines of the venture into space, and try to determine the specific roles of the government and private enterprise.

The exploration and use of space, like any other exploitation of a new frontier, will probably proceed in three main stages: (Figure 1) the stage of *exploration;* the stage of *economic development;* and the stage of *mature economic operation.*

I do not mean that these will be entirely separate periods, or that after—say—forty years, exploration will end and economic development will begin. Rather, it will be an expanding picture.

Figure 1: Three stages of development on the space frontier.

First (Figure 2), the area of space near the earth will be explored until it becomes sufficiently familiar, and apparatus becomes sufficiently reliable, for such first industries as satellite communication to be established. We are already well into this phase, and several companies—including General Electric—are already exploring the feasibility of establishing a commercial satellite system for long-distance communications.

Figure 2: At first, exploration must take place near the earth.

Exploration does not stop (Figure 3), but moves outward to the inner solar system, which includes the moon and the nearby planets, Mars, Venus, and Mercury. Economic development follows in the wake of exploration.

Figure 3: Exploration moves outward to the inner solar system, and economic development begins in the space near the earth.

Before long there may be three phases operating simultaneously. The major area of exploration by that time (Figure 4), will probably be in the outer solar system, including the less dense planets Jupiter, Saturn, Uranus, Neptune, and Pluto. Preliminary economic development may be starting in the area of the moon and the nearby planets. And space immediately around the earth—where most of the present satellites are in orbit—will be entering into mature, systematic economic operation with such commercial industries

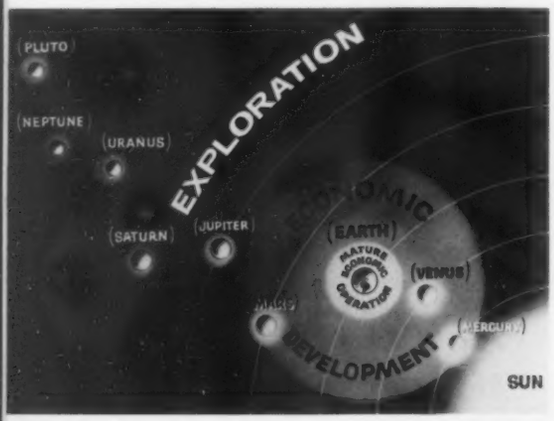

Figure 4: Major area of exploration then moves to outer solar system, economic development begins in the inner solar system, and the space near the earth enters into mature, systematic economic operation, with such commercial industries as long-distance communication, weather forecasting and modification, and terrestrial rocket transport.

as long-distance communication on a large scale, private weather forecasting and modification, and terrestrial rocket transport.

Generally speaking, the exploratory stage is likely to be government-directed, with substantial industry participation; the stage of economic development will be marked by government phasing out and commercial industry phasing in; and the stage of mature economic operation will—if private enterprise is to survive in the space industries—be primarily based on private ownership and operation under suitable government regulation, including some form of international law or agreements.

Now let us look at each of these three stages in some detail.

STAGE 1: EXPLORATION

The first era, already launched, is the exploratory period of sending out satellites and other space vehicles, at first unmanned, then manned, to see what is in space. Basically this is the stage of scientific research, bringing back as much scientific data as possible. It will not offer many opportunities for commercial (as opposed to governmental) business for private firms.

The scale and character of this exploratory space activity is indicated in the 10-year program recently submitted to the Congress by the National Aeronautics and Space Administration. This program envisions the launching of 263 exploratory space vehicles in the next decade, at a cost of about $15 billions. That is the estimated launching cost, and it is not clear whether the estimate includes expenditures for constructing and equipping laboratories and bases, for manning such facilities, and for research and development costs of newer space vehicles and propulsion systems in preparation for the following decade. It appears that the annual budget of the National Aeronautics and Space Administration, approaching a billion dollars in fiscal 1961, could in a very few years run over $3 billions a year if its program is approved.

The scale of this exploratory work, the cost of it, the lack of any financial return for a long time, and the extra expense of hurrying because of international power politics, almost necessarily makes the exploration of space primarily a government-sponsored and government-financed operation. It is useful to remember that the voyages of exploration in the fifteenth and sixteenth centuries, opening up the Americas and the Orient to European development, were also government-sponsored. But the successful economic development was done in the follow-through period by private traders and colonists—at first with direct government support and sponsorship, and later with the governments serving only to maintain order and provide military and naval protection. On the space frontier, the scientific voyages of exploration will also be government-sponsored and financed.

However, the management and operation of these exploratory operations should be done primarily through government contract by private firms, with competitive incentives for superior performance and penalties for failure. Private firms and private universities should design and produce most of the apparatus required to get there and do the exploratory work.

This approach will not only utilize the most experienced scientific and technical organizations in the country, but will also accomplish the objective faster and more economically, and will help prepare the companies for the day when commercial businesses can be conducted utilizing space technologies.

PRIVATE SPACE FACILITIES?

Even in the exploratory phase, must we necessarily assume that all the major facilities should be government owned? As the years pass by, and space apparatus becomes more reliable, and the work of obtaining scientific data from space acquires a more routine character—certainly many of the necessary operating facilities could be put on a self-liquidating, private-industry basis.

Probably the first opportunities for private investment will come in the commercial use of satellites. I have already indicated the interest of private companies in the development of a satellite communication system.

Looking even farther into the future

of space exploration, perhaps there would be economic justification for a privately owned launching service that would put objects into space for the peaceful purposes of friendly governments, international agencies, industry, and the universities. The private company would put so many pounds of payload into such-and-such an orbit, at an agreed price. At present, the idea has little appeal, since the government's Scout program will for a time offer this service free to other nations. But as the number and variety of scientific space launchings increases, and other nations no longer wish to be dependent on the United States government, the possibility may be worth exploring. Perhaps the other nations will not wish to invest in duplicate facilities for what is, after all, an operation of planetary scientific significance. This commercially operated launching service would, of course, be strictly for non-military purposes.

It might be objected that foreign governments would feel uneasy about centering their peaceful space programs around launching facilities owned by an American company, for reasons of national pride and national security. But that question could easily be resolved by having the service owned and operated by an international group of companies—including companies from most of the countries likely to use its services.

The base itself, from which the commercial launching service would operate, might be modelled after a port authority. Such a non-military, international space port could develop as a center for many private enterprises related to space operations. These might include service and maintenance facilities; data-processing services; space communication centers; laboratory facilities; standardized equipment for satellites and other space vehicles; fuel supplies; medical services; biological services; and general supplies.

Moving away from the idea of a commercial space port, must all future tracking stations, observatories, and data-processing stations be government owned? How about experimental stations for the simulation of space environments? How about laboratories and stations actually constructed in space? Or will privately owned facilities one day offer these services on an international basis to governments, industries, universities, and international agencies?

In a preliminary way, General Electric and other companies are indicating their answers. General Electric in 1960 will build a new Space Technology Center near Valley Forge, Pennsylvania. It will be built entirely with private funds. These facilities will be expanded as the needs become apparent. Even before the laboratory is built, for example, the Company is studying the feasibility of constructing a space environment simulator, duplicating in one 30-foot sphere many of the conditions of extreme cold, vacuum, and radiation that will be encountered in space. The need for a number of such space simulation facilities is not only predictable, but increasingly urgent. There is no reason why the taxpayers should have to build all of them if private industry is willing to make an investment, and the government is willing to use private facilities as the major customer in the years immediately ahead.

The Valley Forge facilities, although they will cost several millions, are only a small investment compared with the space facilities and launching services I was suggesting as possibilities a few moments ago. But they are a start in the direction of private investment in the economic development of space.

THE MONOPOLY QUESTION

One of the standard criticisms of the entry of private business into fields requiring such high capital investments, and depending so much in the beginning on government business, is that the government may actually be helping to establish a private monopoly. For example, some years from now there may be enough business for one commercially operated launching service, but not for several competing facilities. In this case, it is argued, you do not get the advantages of competition, so why not establish a government facility in the first place?

There are three good answers to this argument. One is that the private facility, even if it is temporarily a monopoly, still has to meet the discipline of earning a profit and avoiding a loss, and hence would be more efficient than a government facility; two, the government would in effect regulate this monopoly because it would be the major customer for some time; three, the monopoly would only be temporary. It would serve the important function of laying the groundwork for competitive private enterprise in the particular field, and keep it from being pre-empted by government enterprise.

The story of transoceanic air transportation is an illuminating example. In the early 1930's, there were no transoceanic airlines. But it was obvious, technologically, that scheduled transatlantic and transpacific air traffic would someday be possible. To assure leadership for the United States in this important field, Pan American Airways explored the routes and established scheduled transoceanic service. At that time there was no American flag competition in transoceanic air travel, and government airmail contracts were granted to help make the business possible in the early years. This proved to be a wise policy, because United States leadership in international air transportation is now a fact. And Pan American has long since ceased to be the only transoceanic service. International air travel is now a vigorously competitive business, providing reliable, low-cost service for millions of passengers every year.

Surely this instructive example shows how industry and government can cooperate to assure that United States leadership will be established in the peaceful uses of space, on the competitive private enterprise basis that assures efficient low-cost service for the public.

The challenge, of course, is primarily to industry itself. Private enterprise must have the vision and courage to encompass its emerging opportunities, invest the capital, and work for the legal and policy changes essential for success.

STAGE 2: ECONOMIC DEVELOPMENT

As the exploration of space pushes farther and farther out, the "inner

space" near the earth becomes sufficiently familiar for the next stage to begin: the stage of economic development.

This stage is a prelude to the time when space will be as familiar as land, and mature commercial businesses can be conducted. The developmental period will be a period of infant industries and expensive risks.

Most likely the first businesses suitable for commercial operation, using space technologies, will be world-wide communication by satellite, private weather forecasting, and high-speed earth transport by rocket. Each of these possibilities is being discussed in detail by other lecturers, and therefore I will not describe them here. Instead, I will suggest the appropriate roles of government and private enterprise in their development.

Businessmen who believe in the competitive private enterprise system are generally opposed to subsidies, with two classical exceptions: defense industries and infant industries of national importance. Most of the early space businesses will qualify on both counts.

Here, in my opinion, are the appropriate roles of government and private enterprise in starting these early commercial businesses in space.

The preponderance of the research and developmental work and special facilities should at first be financed by government, because of the national interest in establishing United States leadership. But the companies concerned—in their own interests—should also invest in appropriate facilities and manpower to conduct research and development. As an area of space becomes familiar, government-financed research and development should be shifted outward or to other projects of national interest, and private capital should complete the developmental work.

In these areas with commercial potential, the government should avoid the temptation to build operating facilities (under the guise of demonstration units) that will tend to pre-empt the field for tax-subsidized government enterprise, and prevent the establishment of private facilities. For example, if in the 1930's the United States had established a nationalized airline instead of helping Pan American to lay the groundwork for international air travel, it is likely that international air travel would still be a government monopoly as far as the United States is concerned. The public then would not have the advantage of many private airlines competing for their trans-oceanic business.

Private industry should move as fast as possible to establish these early space businesses, so that the government can shift its efforts to the many other areas of exploratory work.

STAGE 3: MATURE ECONOMIC OPERATION

Finally, we come to the stage of mature economic operations in space. As areas of space become familiar, and businesses become established, the government should phase itself out of this area of economic and technical work, and do all it can to encourage the growth of a vigorous competitive private enterprise economy utilizing space resources.

What these commercial businesses in space may be, no one really can say because we know so little about the potentials. Usually one of the first commercial operations in a new frontier area is to bring back raw materials not available in the home land. It is entirely possible—although many experts now think otherwise—that new or rare minerals and chemicals will be found on the moon and planets, and among the asteroids, that will be unexpectedly useful here on earth. As space transportation becomes more reliable and less costly, and the means of sustaining life in space are developed, it may become economically feasible to mine and bring back these rare metals and chemicals, just as it was worthwhile to haul incense and silk halfway around the world in slow sailing ships five hundred years ago. Some have suggested that, as techniques advance, it might be possible to mount rockets on an asteroid of pure iron or pure nickel —if such exist—and orbit the huge mass of metal down to earth. With high-grade earth sources of metal becoming scarcer with each passing decade, the idea of bringing in a new Mesabi from outer space may be less fantastic in thirty or forty years than it is now. Perhaps the radiant energy of space can somehow be controlled and made useful. Perhaps new medical resources, or new food resources, can be found on other planets. It does not seem probable, but who is to say? Space travel itself, at first for research and then for commercial purposes, may well develop into an economically profitable competitive business. No one can predict how, or even whether, outer space will offer resources that are useful to man; but some very unpromising frontiers in the past have ultimately been tamed.

As the economic resources of space are developed, we must realize that our private enterprises will be competing with the state-operated systems of other nations. But that competition between socialist and capitalist economies already exists here on earth. By the time a mature economy has evolved in space, wholly new forms of economic organization may have evolved on earth—hopefully in a free rather than a regimented context. International laws and treaties with respect to space will be developed at the same time, and we must see that they are compatible with the efficient operation of competitive private enterprise in space.

LEGAL AND POLICY CHANGES

Now finally, your Chairman suggested that I outline what changes should be made in the government's legal and policy framework, to enable private enterprise to make its maximum contribution in the space venture. I am not, of course, prepared with a comprehensive legislative program for the Space Age. In fact, one important principle is that we must not regard space as a completely different area that will require a major break from our established legal and political traditions. The space program must not be used as an excuse for debasing, distorting, or fundamentally changing the nation's distinctive political and economic institutions; as a means, for example, of breaking down the patent system, or of building up a nationalized industry, or of increasing political con-

trol over economic life. Instead, we must recognize that the existing system of business regulations and traditions provides a sound basis for the extension of our economy into space for the benefit of all the citizens, as it has already been extended into the atmosphere by way of airlines, broadcasting, communications, and other industries.

To accelerate that proper extension of our economy into space, and also realize the military and ideological advantages of leadership in space, there are some legal changes that should be made.

NASA PATENT PROVISIONS

The patent provisions of the National Aeronautics and Space Act of 1958 may prove to be a substantial deterrent to progress in space. Furthermore, they could weaken and ultimately destroy the long-established patent system which has proved to be a key factor in the growth of the nation's economy.

The present provisions of the Space Act, like the patent provisions of the Atomic Energy Act, depart radically from the patent policies of the Defense Department and of industry generally by requiring that the government receive title to all contractor inventions, subject only to a possible waiver at the discretion of the administrative authorities. From our own experience in General Electric we know that such hasty decisions that violate well-tested practices to meet alleged emergencies or special circumstances usually end up doing more harm than good.

Testimony before Congress indicates that under the policy of uncertain patent protection, companies have been hesitant even to accept contracts for space projects that have interesting commercial possibilities. The witnesses made this point: If a company has invested much of its time and money in developing a certain technology, is it realistic to expect the company to liquidate this investment by turning its knowledge over to its competitors by way of the Space Agency?

As it is, only the most readily adaptable inventions made under Space Agency contracts will be developed for consumer and industrial use. Many other inventions requiring greater pioneering effort will lie undeveloped because the inventor company has no incentive to invest in the development of a commercial market; his competitors could easily put a copy on the market just by getting a free license from the government.

We must ask ourselves: can this country accept the loss of the historic patent incentive and yet win the space race?

Fortunately, a subcommittee of the House Committee on Science and Astronautics has recognized the problem, and has developed what appears to be a sensible legal and administrative solution. The Congress should correct the situation as quickly as possible.

INCENTIVES FOR PERFORMANCE

Since so much of the initial work in the exploration of space must be done under government contract, the government should realistically offer economic as well as patriotic incentives for outstanding performance in the public interest. Under the government's customary cost-plus-fixed-fee approach, outstanding performance or economy offers little immediate reward. For highly complicated research and development projects, competitive bidding on a straight price basis does not provide the answer. Too often, a contractor would be tempted to submit a very low price and then devote himself to doing the minimum necessary to fulfill the contract. Instead, contracts must be negotiated that offer exciting incentives for exceeding agreed standards of performance, economy, and speed—and sizeable reductions in fees in case of failure.

For example, General Electric's Missile and Space Vehicle Department has a contract with the AMC Ballistic Missiles Center that moves in the right direction. It is a contract to come up with the next generation of nose cones, a two-year research and development contract. The target fee for performing the work was negotiated with incentive provisions that provide a substantial increase in fee for exceeding certain measured performance standards, time schedules, and cost targets. And its fee can be reduced by the same amount by failure to meet these standards. Thus General Electric has a real incentive for technically bold, high-quality performance.

Contracts like this will gradually separate the efficient from the inefficient among the contractors. This is real competition. Such profit incentives will not replace, but supplement the motives of duty that encourage leading companies to accept contracts and invest in their own research and development facilities.

INDEMNITY PROBLEMS

The Congress must also accept the indemnity problems that may be too big for private companies to carry, on some future projects. For example, space vehicles propelled by nuclear power are a future possibility. There is an extremely remote possibility that one of these might fall in a city and do widespread damage to life and property. The ensuing liability suits could wipe out or profoundly cripple any private company that was in some way legally liable for such an accident, even though it could do nothing to prevent it. The government will have to develop some system to limit the private liabilities in the case of these highly improbable accidents, or companies will be unwilling to risk their entire existence by taking such contracts and the public would have no real way to recover damages. The Congress has already recognized the indemnity problem in the atomic energy area and in connection with international air travel.

ANTI-TRUST LIMITATIONS

The anti-trust laws are a vital bulwark of the competitive system, and must be vigorously enforced. At the same time, the large and expensive projects that will win space leadership for the United States will require much larger companies, or even teams of companies, perhaps on an international scale, to carry them out successfully. The law should encourage, rather than inhibit, such large-scale undertakings. Section 708 of the Defense Production Act of 1950 already allows exemptions from the anti-trust laws for certain

voluntary agreements and programs among companies in furthering the national defense. This points the way toward recognizing the need for larger financial and technical aggregations in the Space Age.

INTERNATIONAL LAW

Any frontier must be subject to law and order. Earth boundaries obviously mean very little in space, and hence a structure of international law and treaties must be developed. The maintenance of order in space will have to be the function of an international agency—most likely the United Nations.

REGULATION AND LICENSING

Because of the international and defense complications, it will probably be necessary to have a system of regulation and licensing for private uses of space. The duties of the regulatory agency should be clearly defined, to be sure that the regulatory powers will be used only to assure public safety and necessary technical standards. Such regulatory powers should not be so broad that they can be used to control and shape industry in accordance with the personal preconceptions of the staff of the agency.

POLICY DIRECTION

The need for speed and efficiency in the exploration of space requires more coherent policy direction from the Federal Government. The individuals who hold responsibility in the various agencies appear to be doing their best to bring order out of chaos, but their efforts in some areas of the space program seem to be frustrated by a confused and top-heavy administrative arrangement.

I have not studied the organization in detail. I would only suggest that the number of reviewing committees be kept to a minimum because they can become devices for evading responsibility and postponing decisions; that responsibility and authority for decisions rest clearly with the men held accountable for results; and that any incentives to build empires among the agencies be removed by relying primarily on private laboratories for technical work.

CONGRESSIONAL STATEMENT OF INTENT

Finally, to assure that the public and the government agencies involved have no misconceptions of national policy, it would be worthwhile to have a Congressional statement of intent to use competitive private enterprise to the maximum in the management and execution of government technical projects; and to encourage private investment in space-oriented technologies and businesses wherever possible.

OUR CHILDREN'S WORLD

To sum up, then, the world is extending its boundaries out from the planet into space: a tremendous enlargement of the area in which man will find resources for living. To explore and tame the new space frontier will require a great technological effort. The very effort will force many new inventions that will not only be useful to us in space, but can greatly advance industrial productivity and levels of living in the United States and the rest of the world.

Yet the ultimate question that faces the citizens at the threshold of the Space Age is not whether the technical achievements will be made, but how they will affect human life. Will the drive for space push mankind into a steel trap of regimentation, or will it open up new vistas of creativity and freedom? Will the new, larger world of the future, with its boundaries moving out to the other planets and beyond, be a free world or a regimented world?

The answer to this question, the heritage we leave our children, will be determined to a large degree by how the United States—the world's leading industrial nation—goes about the exploration and development of space. If we go at it by the route of regimentation and government enterprise, if we allow the communist powers to establish our course, patterns will be set that will be almost impossible to break. On the other hand, if we use the strength of competitive private enterprise, we will not only advance faster, but will help to assure that the world of our children will be a free world, honoring the dignity and creativity of man.

This lecture is one of a series of twelve presented at the University of California in Los Angeles in the spring of 1960. All twelve lectures will be published by McGraw-Hill Book Company as a book entitled "Peacetime Uses of Space".
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"Two basic strengths... give us a decided advantage over the Soviets..."

I had the opportunity of close association with several of these projects from their earliest beginning. The Polaris project is only one example of the application of creative management to a modern weapon system.

The earliest plans for Polaris were geared to an over-all time scale with each sub-system and component system assigned respective schedules. With these dates firmly in mind, Polaris project management studied and forecast the state of technology of each component part on its required freeze date—not the technical development as it existed at the start of the project, but its performance as it would be at a future date. Based on the best scientific advice, they forecast the specific impulse or efficiency of the propulsion system. They forecast the weight, size and other requirements of the guidance system, the re-entry vehicle and the warhead at their respective required dates in the future. In short, they specified a system based on tomorrow's technology, not today's, nor yesterday's. They had seen the exponential growth of science and engineering in the past and established a development plan to use it to optimum advantage.

To be sure—this approach entails risk. Possibly one of the forecasts will be missed, and a change in course will be required. This risk, however, is not as great as the risk involved in using yesterday's technology and ending a long development cycle with an obsolete weapon.

These principles—organizing and planning—need greater, wider application to more items across the whole gamut of weapons and weapon systems. They will provide both the flexibility and sound stability to deliver the precious product of innovation more quickly and at less cost.

Conversely, we in industry are learning tremendous lessons from military work through the sheer, fantastic complexity of working with modern weapon systems—lessons which will stand us in good stead in our nonmilitary competition with the Soviets. One of the great advances of our industrial society in the 1950's was a better appreciation of what is involved in (and therefore how to organize for) systems management.

3. Industry–Government Integration

As a key to industrial management of our resources, we must work toward a fuller integration of government, industrial and scientific intelligence. Integration is not a case of one dominating the other; it is leading, inspiring, pulling together of the activities of decentralized organizations—industrial *and* government. This is an area demanding advanced management sophistication, competence and mutual respect.

This does not, of course, relieve the military from the responsibility of understanding (but not conducting) the industrial effort; nor does it relieve industry from the responsibility of grasping the significance of long-range defense planning, such as we are endeavoring to understand through the TEMPO organization.

4. Measurement Provides Efficiency

Finally, and certainly not least important, is industry's job of ever increasing its efficiency in carrying out its job of manufacturing and delivering these systems to the troops in the field. To maintain this efficiency, the key factors are the development and effective use of true measurements of our performance. When we measure our performance and properly reward good work and penalize poor work, we need have little concern as to our future. Unfortunately, this is not nearly as easy to do as it is to say.

When our defense establishment buys a hundred thousand standardized and proven rifles, the measurement can be largely the price bid by several qualified suppliers. When our government buys innovation and new technology, perhaps a new space communication system, we need new yardsticks to make our measurements of performance meaningful. When you buy a new automobile for your personal use, you consciously and, in fact, subconsciously weigh a multitude of factors—price, quality, the manufacturer's reputation, and numerous others, and when six million do this each year it results in our automobile manufacturers being measured and rewarded by the world's most effective system.

We have a long way to go to develop equally efficient measuring systems to apply to those supplying our most complex military weapon systems. One thing we must do is to make increasing use of data-processing and computation equipment. The same electronic computers

used in engineering design, development and operation of a missile system, can and *must* be applied to the measurement of industrial performance and efficiency.

As a small start on solving the measurement problem we, in General Electric, with the full cooperation of the Air Force, are trying a new type of Research and Development contract. This allows us to measure at least in part the performance of a large group of engineers and scientists concerned with the development and manufacture of highly complex ballistic missile re-entry vehicles. This contract provides performance incentives based on a large number of measurable quantitative factors in a creative development program. Just how often this procedure can be applied will depend on the ingenuity of both government and industry management.

Increasing the efficiency of creative development through measured performance need not stifle innovation. But, particularly with shortened life span of weapons effectiveness, greater complexity and increasing cost of defense products, we cannot afford to find ourselves dedicated to innovating obsolete products. We must use every measurement tool at our disposal—whether it be computers or just plain management horse sense—to make sure this does not happen.

A Race Towards Management Innovations

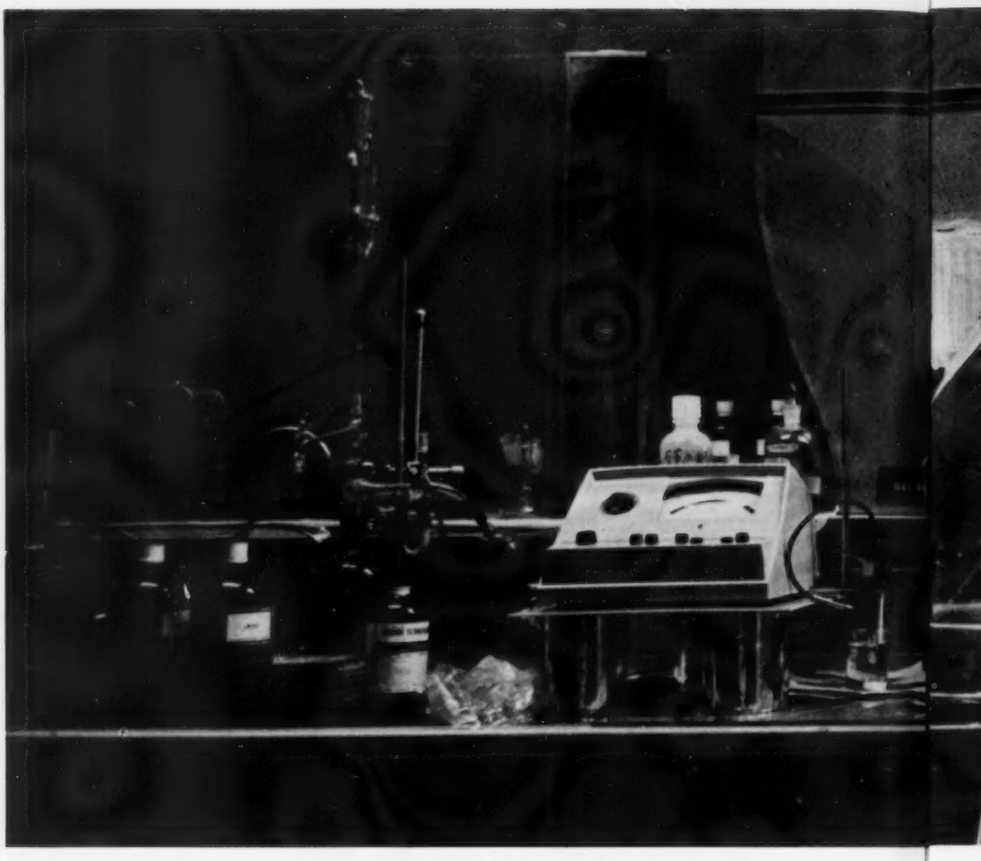
In the future, we will see an even faster race towards management innovations, with the United States and Soviets running a close race—using many of the same techniques. Two basic strengths—our centers of individual initiative and our greater management sophistication—give us a decided advantage over the Soviets in the advancement of weapons or non-weapons.

But it will take more than this to maintain our national and economic security. In our free-enterprise system, it will require broad understanding by our citizenry of what is going on in the political and economic climate of the entire country. They must know and understand the problems and strengths of government and industry in a free society.

Developing this climate becomes a matter of obvious concern to everyone interested in national security. If the type of company I represent has made any creative contribution to understanding in this field, it might be this: that the climate for business is not one vast, vague, unmanageable situation beyond human control, but an accumulation of individual, recognizable, manageable problems that can be dealt with at the local level. Since our state and national representatives in government are almost all accountable to some local constituency, even the state and national problems are ultimately responsive to local action and opinion. Therefore, the solution to the problems of business climate lies in individual, grass-roots study and action on an issue-by-issue, item-by-item basis.

The leadership for this action must necessarily come from responsible professional and industrial leaders. Who else is going to do our work for us? Every citizen stands to gain from a climate that enables business to provide better jobs, products, and profits, but progressive managers—men who should and must know economic life intimately—must rally public understanding and support for corrective action.

We in General Electric believe that such work to maintain and improve the business climate is part of the regular work of every person concerned with our industrial progress. In fact, working to maintain and improve the business climate is a test of the quality of our business leadership—perhaps a true measure of our ability to manage our resources for defense and prosperity.



HUMAN RESOURCES: MEANS OR END

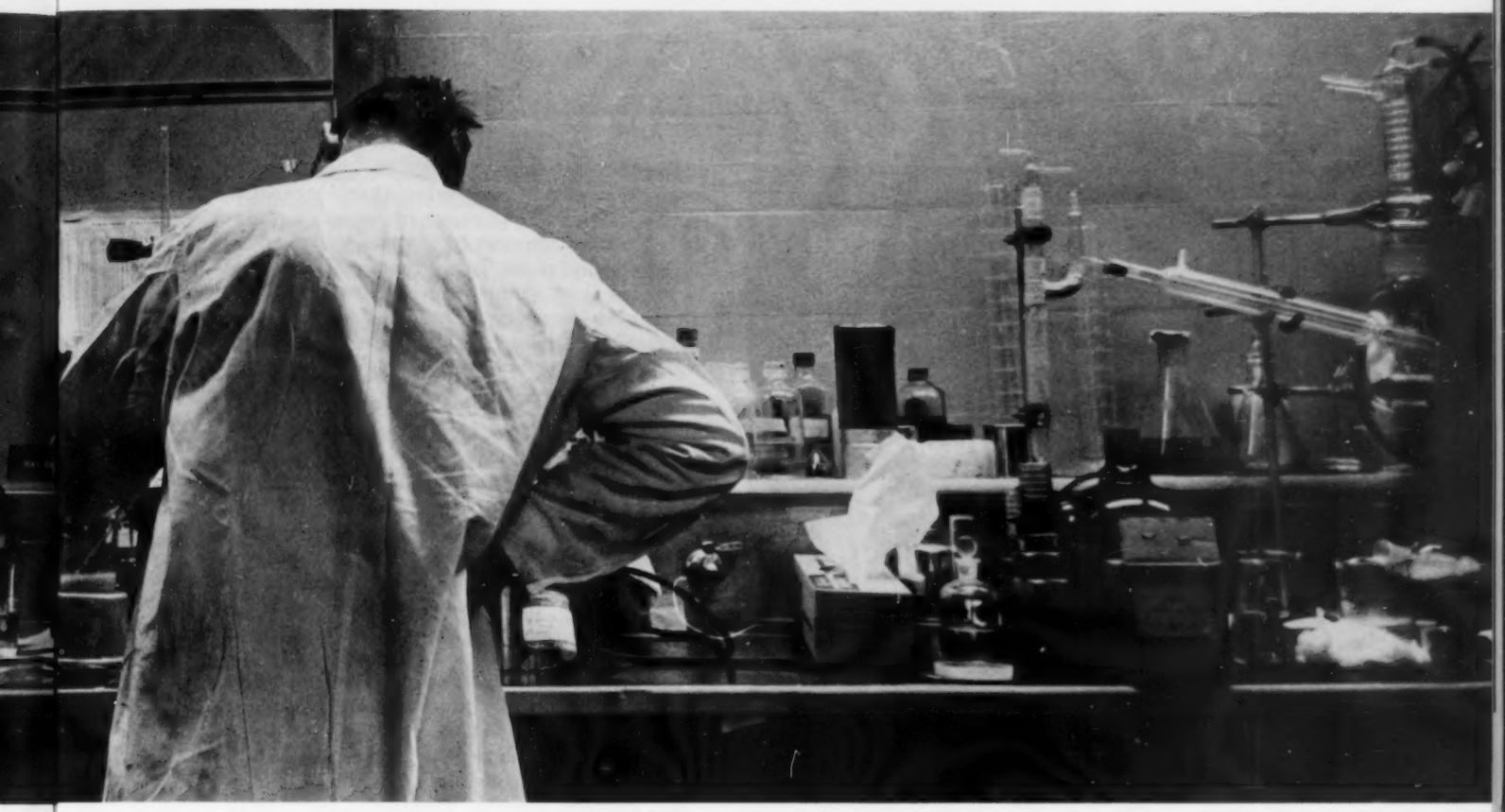
by Dr. Eli Ginzberg, Director, Conservation of Human Resources Project, Columbia University

Dr. Ginzberg is a pioneer and internationally-recognized authority on the economics of human resources. In this article, he takes a frank and questioning look at U.S. manpower use, and calls for:

- **Increased attention to educational facilities.**
- **A closer look at current influences on manpower development and utilization.**
- **Improvements in government and business management of trained manpower.**

History is full of paradoxes. For example, it was not until World War II, when the United States was engaged in the very wasteful endeavor of war, that we first became aware of the importance of our human resources. I have never seen the etymology of the term "human resources," but I do not think that it was part of our language prior to that time.

The recent order of concern with, and interest in, the nation's human resources indicates that we have had relatively little time to fashion effective bases for analysis and policy. Small surprise, therefore, that we are loaded



down with information that is not always knowledge and policy that is not always sound.

Lessons from the Last Decade

Like nuclear physics, the study of human resources is a very young discipline, but there is a marked gap in the hard core of their respective accomplishments for the reason that Max Planck emphasized long ago: physics is so much simpler. But progress in intellectual and social life comes about not only through positive accomplishments of a theoretical or experimental nature, but also through acknowledgment of errors in established ideas and through new understanding of why important programs and policies fail to accomplish their objectives.

What lessons should this country have learned about human resources as a result of its experience during the 1950's? Let us limit ourselves to five of major importance.

Changing Personnel Demands Create Waste

The first lesson comes from the dangerous disruption and waste that results from sudden and substantial changes in the demand for scientific and engineering personnel.

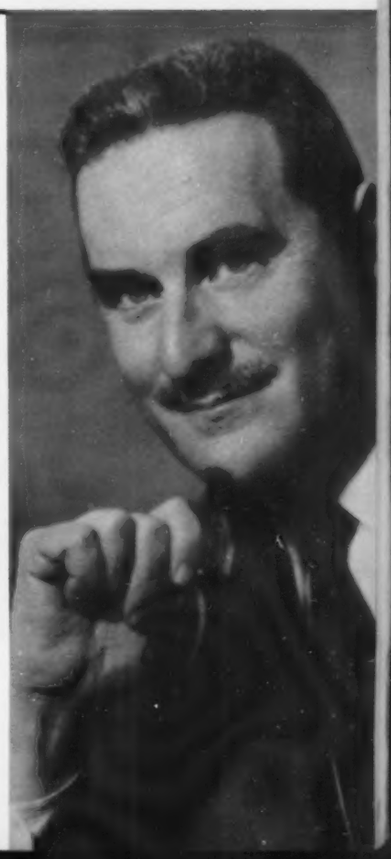
It matters little whether the shift in demand is suddenly downward, such as occurred just prior to the Korean War and again in 1958; or whether the shift is strongly upward, such as occurred in 1951–52 and in the other periods of recovery following recession. In either case, in response to changes in demand, individuals shift in or out of programs of study without adequate consideration of their own capacities and interests and without properly evaluating

"Human beings carry a lot of defects, but they have the assets to meet the usual demands of society." This statement by Dr. Eli Ginzberg reflects his optimistic outlook through almost a lifetime of studying the economics of human resources.

Some career highlights: winner of an experimental high school top award for proficiency in social sciences at 13; author of the "Economics of the Bible" while a college junior; winner of a fellowship which took him on a 40,000-mile, 40-state, year-long probe of the American economic scene at 23; author of a World War II personnel study which drastically streamlined military operations.

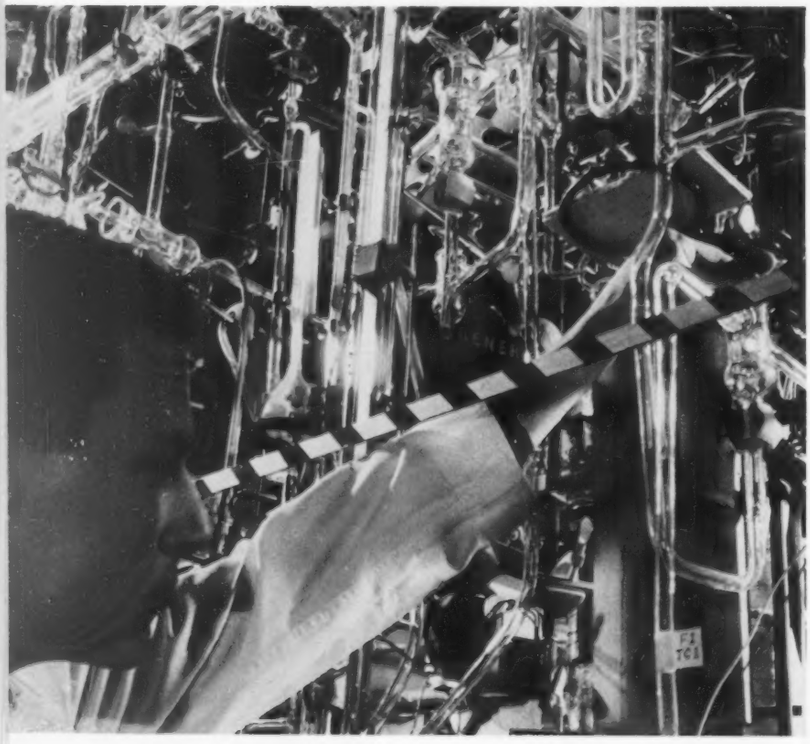
Associated with Columbia University through much of his career, Dr. Ginzberg's work has been strongly supported by President Eisenhower since the days of World War II manpower studies. He has been a continuous consultant with the Department of Defense since 1942.

Author of numerous books, perhaps his best known is, "The Ineffective Soldier," three-volume end result of an eight-year study which has been applied extensively in civilian as well as military manpower evaluation.



"... deficiencies in quality can rarely be compensated for by quantity."

Fundamental factors in career decisions today are length and difficulty of preparation, working conditions, earnings, promotion opportunities.



their true career opportunities. The appalling attrition rates in engineering schools are indicative of the waste in career planning.

A second response to changes in demand is the musical-chair game that many trained persons play in moving among employers. The excessive turnover of technical personnel in aircraft and related industries is testimony of large-scale wastes in utilization.

Quantity No Substitute for Quality

Second—we tend to confuse quantity with quality. While the two are never completely independent, deficiencies in quality can rarely be compensated for by quantity.

At one point of the Korean War, when the research and development programs of the Armed Services were being held back not by lack of funds but by lack of scientific personnel, a leading automotive manufacturer informed the Pentagon that he could make available perhaps as many as two to three thousand engineers for work on government contracts. A quick survey revealed, however, that these men were so specialized that they simply could not be helpful in breaking the bottlenecks in the military research program. They simply were not sufficiently broadly trained to be convertible.

Recruiting Benefits Limited

Third—propaganda and public relations are weak tools with which to bring about significant increases in the nation's supply of trained manpower.

For many years the leaders in the engineering profession have engaged in a major effort to increase the numbers of young people entering engineering. For even more years, the leaders of the nursing profession have been trying to entice more girls into nursing. Recently a strong effort has been made to swell the numbers entering upon a teaching career. It might be an exaggeration to say that such intense recruiting efforts have been fruitless, but surely their contributions have been limited. Young people with an above average intelligence and education are likely to make their career decisions in response to more fundamental factors—length and difficulty of preparation, prospective working conditions and earnings, promotion opportunities—rather than to the blandishments of Madison Avenue even when these are wrapped in appeals to patriotism.

Confused Manpower Use

Fourth—much heat but little light has been shed on questions of manpower utilization.

Some years ago, Lamont duPont was asked how many people worked in his two large headquarters buildings in Wilmington. He re-

plied, "About half!" The fact that women, members of various ethnic or religious minorities, and Negroes have been able to make their way only slowly up the occupational ladder is suggestive that even in periods of manpower stringency, discrimination practices can be eradicated only with difficulty. The debacle about work rules in the recent steel settlement is further evidence of confusion on the utilization front.

Educational System Changes Come Slowly

Fifth—the institution primarily involved in preparing young people for work and life—the educational system—can be reshaped and strengthened only very slowly.

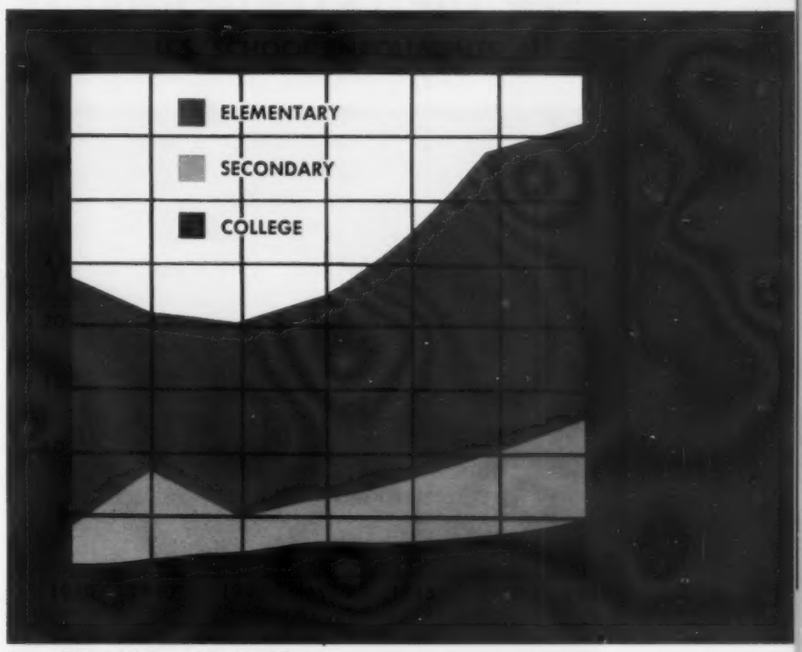
In the United States there are more than 125,000 public schools, which have an enrollment of about 35 million pupils, taught by over 1.3 million teachers, for salaries approximating $6 billion annually. It is clear that significant changes in the educational preparation of the young could be accomplished only slowly, even if, as Admiral Rickover assumes, the exact reforms were known. It would be simpler to expand the pattern which exists: all that is necessary is to convince the public and its elected representatives to provide more money. While this is seldom easy and sometimes impossible, it is not generally as difficult as to increase the number of able teachers, deepen the curriculum, and motivate pupils to do their best.

The costs of sudden shifts in the demand for trained manpower, confusion of quantity with quality, the limitations of intensified recruitment as a solution for shortages, the pervasiveness of faulty utilization practices, and the difficulty of improving the educational system —these are five important lessons that can be learned about human resources from our recent experience.

The Decade Ahead

What are some of the more important aspects of our human resources that will be in the foreground during the decade which is ahead? And how can we handle them so that our economic and defense objectives can be more readily achieved? Once again, let us single out five elements for quick inspection.

Many of the problems of the 1950's grew out of the fact that twenty years earlier the number of births had declined as young people, because of the depression, postponed marrying or starting their families. With the suddenness that is characteristic of American life, the 1960's will face the opposite challenge—the need to absorb the vastly increased number of young people who each year will reach working age.



Source: Industrial College of the Armed Forces

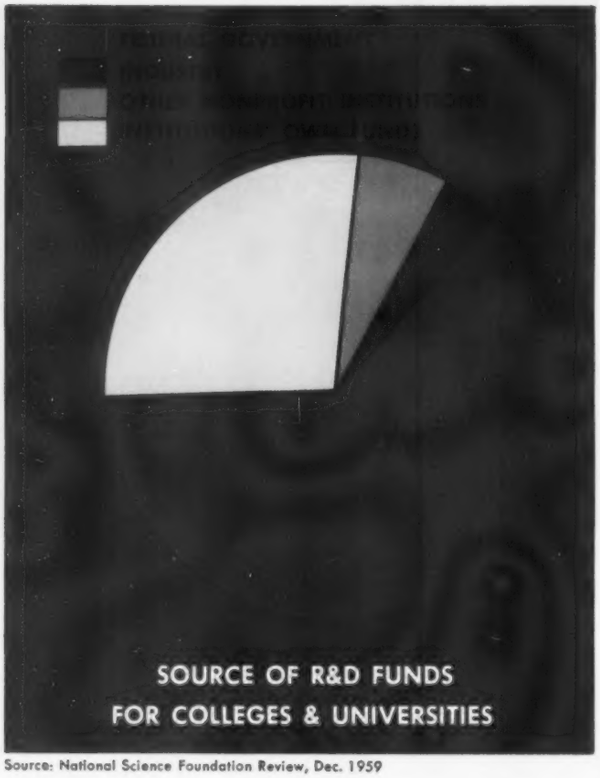
Increased Need for Educational Facilities

This important demographic change, together with the long-time trend of the increasing proportion of the population that completes high school and enters college, may well lead, as so many anticipate, to excessively heavy pressure on the available facilities for higher education. The recent steep rise in tuition and living costs and the relative decline in the economic value of the baccalaureate degree may, however, reduce the pressure.

The emerging situation represents both an opportunity and a danger. If we facilitate the entrance of abler students into better colleges, then we will strengthen our manpower resources. But if, as seems likely, we fail to make the changes that will insure this, we may see the perpetuation of the mediocrity that has long characterized such a large segment of higher education.

However, changes on the educational front cannot be achieved without alterations in key social values and behavior patterns. One half of all the women who marry do so between the ages of 15 and 19, and in general marry men who are only two or three years older than they. Moreover, these young people start their families early. A great many college students, and more students in graduate and professional schools, must divide their time and energy between their books and other responsibilities.

"if . . . we fail to make . . . changes . . . we may see the perpetuation of . . . mediocrity . . . ."



Source: National Science Foundation Review, Dec. 1959

After their graduation, most of them seek jobs that will insure immediate financial support for their families. They cannot take risks; they cannot seek out challenging work if it pays less. The tragic concomitant of this results from the fact that, unless the younger generation wants to remake the world, it will not be remade.

What About Federal Support?

We talk blithely about the virtues of federalism and our free enterprise system—and these virtues are not to be underestimated—without fully realizing the extent to which the Federal Government, especially through its research and development program, is reshaping both. The science departments of our largest universities are almost completely dependent on federal grants and projects. The Federal Government is by far the most potent factor in medical research and it is steadily expanding its support for other areas. It is also providing a large part of the risk capital for industry. The centralized expenditure of very large sums cannot fail to exercise a major influence on the development and utilization of the nation's manpower resources, and not necessarily for the good.

Finally, the 1960's will, we hope, see improvements in the management of our trained manpower resources, both in government and business. No one who has even a fleeting acquaintance with the Pentagon or large-scale industry can question that more problems about the best ways of utilizing highly trained personnel remain to be solved than have yet been solved. There are no easy answers to how a group of generals or an executive committee can reach sound decisions about where to place their research money or how best to exploit successful breakthroughs. But we are in a position to learn from our experience, if we have the wisdom to do so.

The Inherent Dilemma

These are serious challenges that lie ahead: to provide adequate opportunities for the increased numbers of young people reaching working age, to protect and improve educational standards, to resolve conflicts between demands of family and work, to insure that government does not seriously distort the structure of science and scholarship and, finally, to provide more effective management of scientific personnel in large organizations. To the extent that we solve these problems, our economy will be stronger and our defenses more secure.

But we are, nevertheless, confronted with a dilemma. Since the protection of human life and liberty is the purpose of a democratic society, the more efficient use of potentialities and skills of individuals cannot be sought through means that restrict their freedom of choice or action.

Rather, a democracy must seek to broaden these opportunities. In the past, this approach has succeeded, for in helping the individual better to realize his potentialities the nation has been strengthened.

But faced as we are with an aggressive opponent, we can no longer afford to rely on the slow mechanisms of an earlier day. We must improve our planning and operating procedures so that, while consistent with our democratic tradition, they will enable us to engage successfully in the intensified competition for world leadership in the atomic age.

Managing Our Energy Resources for Defense and Economic Growth

by Philip Sporn, President, American Electric Power Company

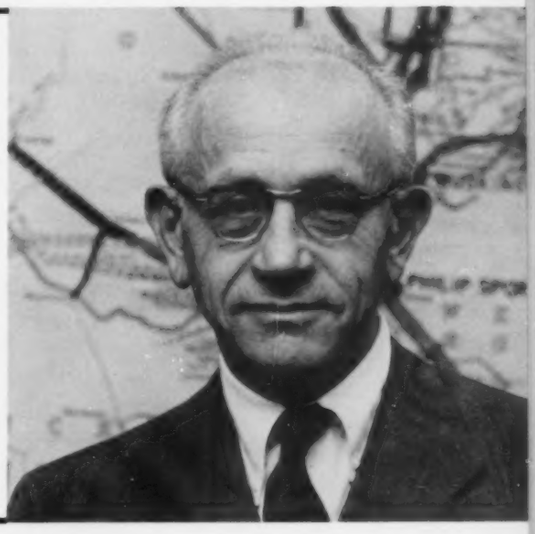
A world-known electric utility executive and outspoken authority on U.S. energy potential predicts energy availability for the next 40 years, relating it to future U.S. defense and economic growth. In this country, by the year 2000:

- **There will be a 2½ times growth in total energy production.**
- **Electric energy output will reflect a 10-fold increase.**
- **Nuclear energy may account for 21% of the total energy source.**

Under the leadership of Philip Sporn, the American Electric Power Company has pioneered numerous advanced engineering concepts. A major breakthrough was the first transmission lines in the U.S. to operate at 345,000 volts, resulting in previously unattained thermal generating and transmission efficiencies.

Mr. Sporn has been active in the study of nuclear power, has served on numerous AEC Ad Hoc Advisory Committees, and was a 1955 U.S. delegate to the Geneva Conference for peaceful uses of atomic energy.

Joining American Electric Power Company in 1920, he rose through the ranks to chief engineer in 1933 and was elected president in 1947. His published works include authorship and co-authorship respectively of two books: "The Integrated Power System" and "Heat Pumps." Mr. Sporn is a 1956 recipient of the John Fritz Medal, highest U.S. engineering award.



"... slow evolutionary

among the various

At the outset it is important to define the kind of defense being visualized in this discussion. Without claiming any expert knowledge in this area, it is my judgment that the greatest likelihood is for the continuation over a long period of time of the kind of defense situation in which we now find ourselves. This would require the continuation of a strong, militarily deterrent position while, at the same time, maintaining a vigorous expanding economy. The importance of maintaining the economy would continue to derive from the need to exploit to its fullest potentialities the politically and economically free organization of society; to meet the responsibilities that are bound to continue to be placed on the United States as the leader of the Free World; and to strengthen both militarily and especially economically the newly emerging, as yet uncommitted, underdeveloped and developing countries.

This postulate, which assumes the long-term maintenance of military strength adequate to deter or, if necessary, successfully to wage both limited or nuclear war, sharpens the importance of economic growth and thus brings energy resources strongly into focus. The ability to support over a large period of time—perhaps many decades—the economic burden of a strong and fully effective military deterrent, while at the same time fulfilling our international economic obligations and satisfying the aspirations of the American people for rising levels of welfare, is going to depend on a continued dynamic expansion of the American economy. Thus economic growth will occupy, if not the keystone, at least an indispensable position in the arch of our national defense. Energy, without which a modern growing and dynamic economy is impossible, will thus not only continue to play an important part in the defense of the country, but perhaps a more important part than it does today.

The reason for this is too well known to require any extensive comment. The higher productivity necessary in the kind of economic contest in which we are engaged is dependent upon the much greater utilization of more elaborate and more powerful tools of production. These in turn require increasingly large quantities of energy for their operation.

Before examining the future energy requirements it may be well briefly to review the history of energy use in the United States.

200 Years of Energy Use

The commercial exploitation of mineral energy in the United States is roughly 200 years old. The bicentennial of the first commercial production of coal, which occurred in Virginia, will be held this year. The Titusville

change, rather than any radical shifts . . . energy sources, is likely to continue."

Centennial was celebrated last year. Yet, at first, the progress of mineral energy use was slow. A hundred years ago total nonanimal and nonhuman energy use was the equivalent of 90 million tons of coal a year. The chart below graphically portrays the evolutionary realignment of the use of mineral energy fuels at significant points from 1860 to 1957. Predictions for the future also are shown.

The important fact to notice is that the role of each new energy source developed to a significant magnitude only over a long period of time, and then did not fully displace the older fuel. This kind of slow evolutionary change, rather than any radical shifts in the relationship among the various energy sources, is likely to continue.

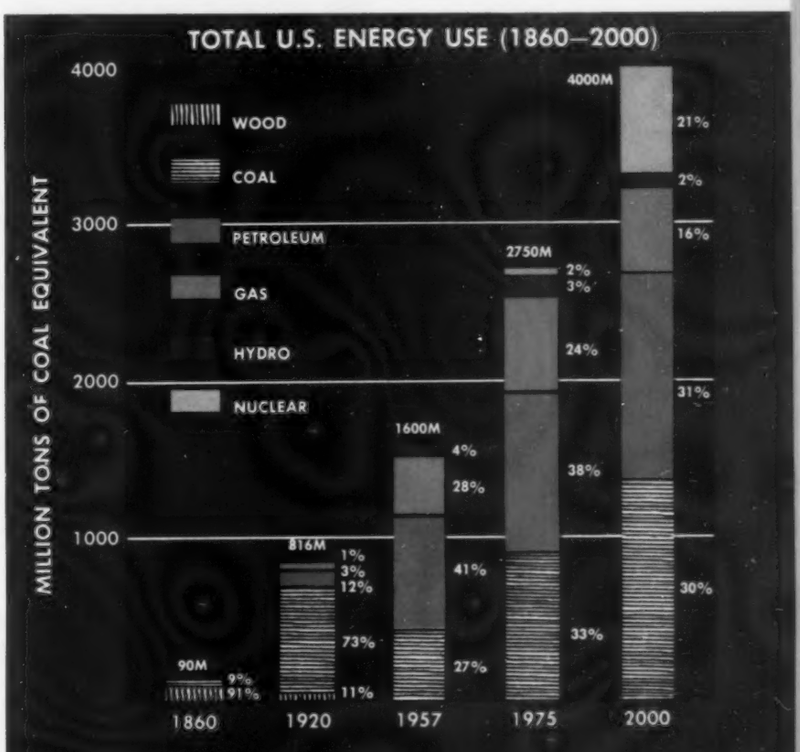
For 1975 our projections indicate a 72% increase in total energy use. The distribution of supply will be somewhat different, although not sharply so, from that of 1957, as nuclear energy begins to emerge as a new force in the total energy picture.

Projections for the Year 2000

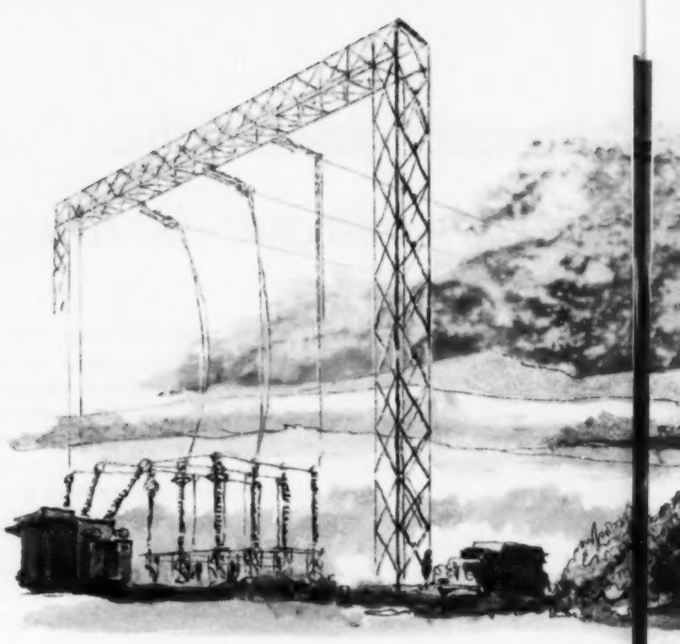
What about the year 2000? I have attempted to project the figures 40 years ahead, despite the difficulties and uncertainties of such long-term projections, for two reasons: first, because nuclear power is still in its very early developmental stage, and it is necessary to project far ahead to develop some evidence of the important role nuclear power is likely to play; and second, the year 2000 may well be within the time span of the kind of defense situation I have postulated.

By the year 2000 we visualize a total energy demand of 4000 million tons of coal equivalent. However, as the chart portrays, in the quarter century intervening between 1975 and 2000, there will be a significant change in the distribution among the five primary energy sources, with nuclear energy increasing substantially.

I think the great significance of these projections is that while they indicate almost a 50% growth in total energy production during the



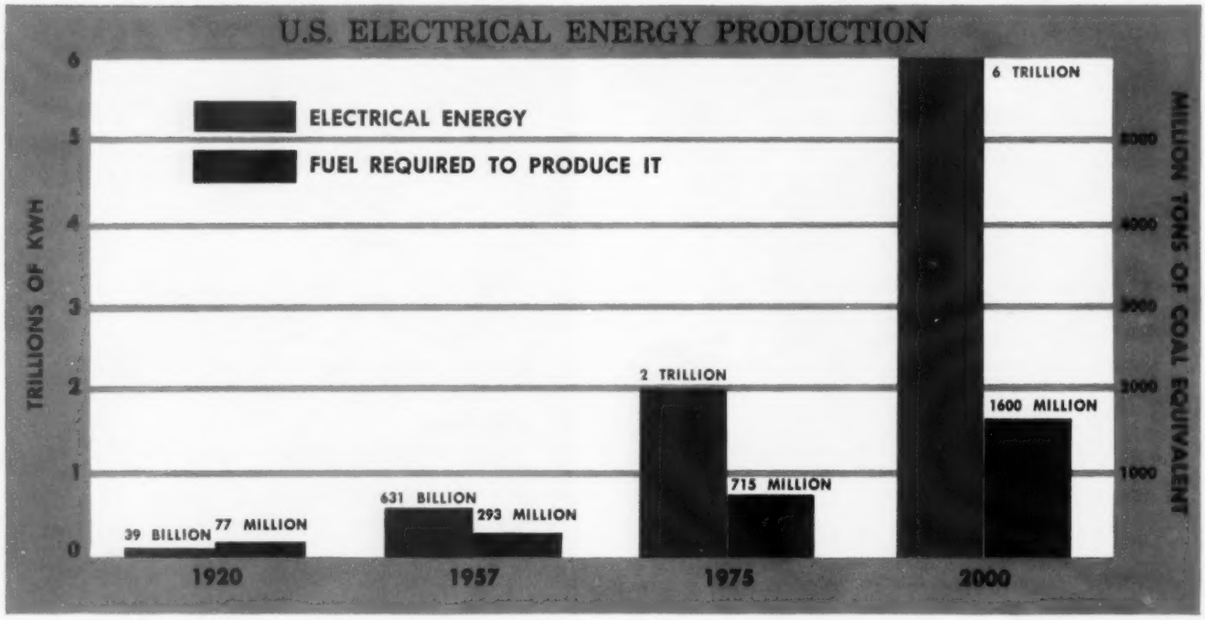
"For 1975 . . . a total electric energy production of two trillion kwh, a growth of 220% from 1957."



quarter century, and a considerable growth in nuclear energy, there remains a continued principal dependence on fossil fuels—almost 80% of the total—despite the relative declines in oil, gas, and coal. This implies confidence in the continued availability of adequate supplies of fossil fuels. I would point out that the figure of 21% for nuclear energy is based on the most optimistic assumptions for that new energy source, and represents what I believe to be the maximum share of the total energy supply that nuclear energy can furnish by the year 2000. It may, and quite likely will, be quite a bit lower.

Electric Energy Will Grow in Importance

Electric energy is an especially important segment of the total energy picture which will continue to grow in importance. Electric energy, starting in 1882, had by 1920 reached an output of only 39 billion kwh (see chart). Even at the then inefficient ratios of conversion of coal into electric energy, to do this required a coal equivalent of only 77 million tons of



coal, or only 9½% of the total energy consumption.

But by 1957, as the chart shows, the picture had changed considerably. Electric energy production had experienced a 16-fold growth in 37 years, while the fuel consumed in the production of that electric energy was less than four times the 1920 figure. And yet, despite the increases in efficiency which made this possible, the fuel converted to electricity represented 18% of the total energy output for 1957—double the 1920 share. It is now close to 20%.

Two Trillion KWH by 1975

For 1975 an optimistic but still conservative projection (see chart) is for a total electric energy production of two trillion kwh, a growth of 220% from 1957. The energy consumed for the generation of that total will account for 26% of the estimated total energy requirement in the United States for that year. In spite of great improvements in the efficiency of converting mineral energy into electric energy, the share of the total energy accounted for by electric energy generation will have increased in the 1920–1975 interval from 9½% to 26%.

Then in the quarter century between 1975 and 2000, electric energy generation will increase to six trillion kwh. This, I think, is a most important figure if it turns out to be substantially true, as I believe it will be. Also significant is the fact that although *total energy* use will grow significantly during the next four decades to two and one-half times the present level of use, *electric energy*, with much faster growth, despite improvements in the efficiency of conversion, will then account for 40% or double its present share of total energy consumption.

Sufficient Energy to Meet Needs

This over-all picture is based on the assumption that the economy will exhibit the kind of dynamic strength necessary to achieve a successful outcome in this long-term, non-military contest. Such an expansion in the economy cannot take place without the use of these much larger quantities of energy. Among our present four principal energy sources, and as a result of the bringing in the fifth (nuclear energy), there is no basis for apprehension about the continued availability of all the necessary energy to supply the needs of the country today, in 1975 and in the year 2000.

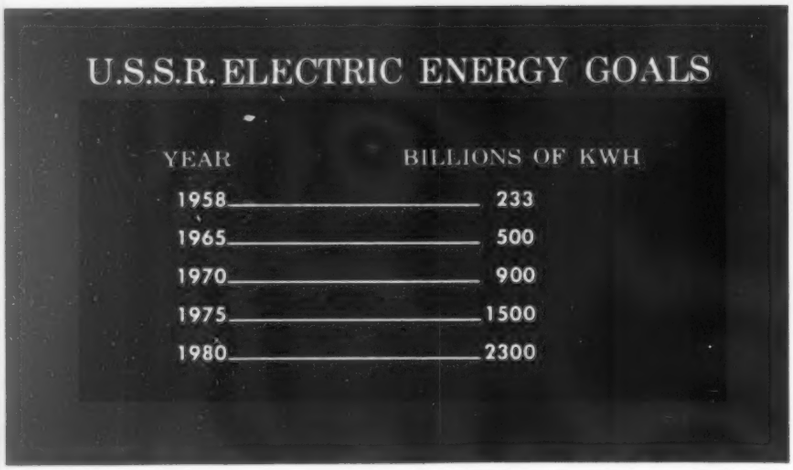
One must add the proviso of assuming that we continue to administer our industry and our social-economic system so as to make possible the continuation of the exploration, exploitation, and development of these energy sources. For example, even with a relative decline to only 31% of the total energy in the year 2000, oil delivery called for is almost double that produced in 1957. Obviously this will mean a great deal of further development of the petroleum industry both within and outside the United States. Or the fact that coal, in the year 2000 at 30% of the total energy supply, will be called upon to deliver almost twice the maximum annual production ever achieved by the coal industry, also means a more vigorous and much expanded coal industry. If the share of atomic energy in the total proves to be less than the maximum I have indicated, it will be because of the continued availability of fossil fuels, and the continued advance in the technology of their use.

Russian Power Development

In view of the current publicity being given

". . . it is important to continue . . .

technological research *or*



to Russian power development, it is interesting to take a look at that situation briefly. Last November, because of their considerable concern about the rate at which the projected seven-year power program, 1959–1965, was moving, the Party Central Committee and the USSR Council of Ministers decided to convene an all-Union conference on power-plant construction. This conference opened in Moscow on November 26, 1959.

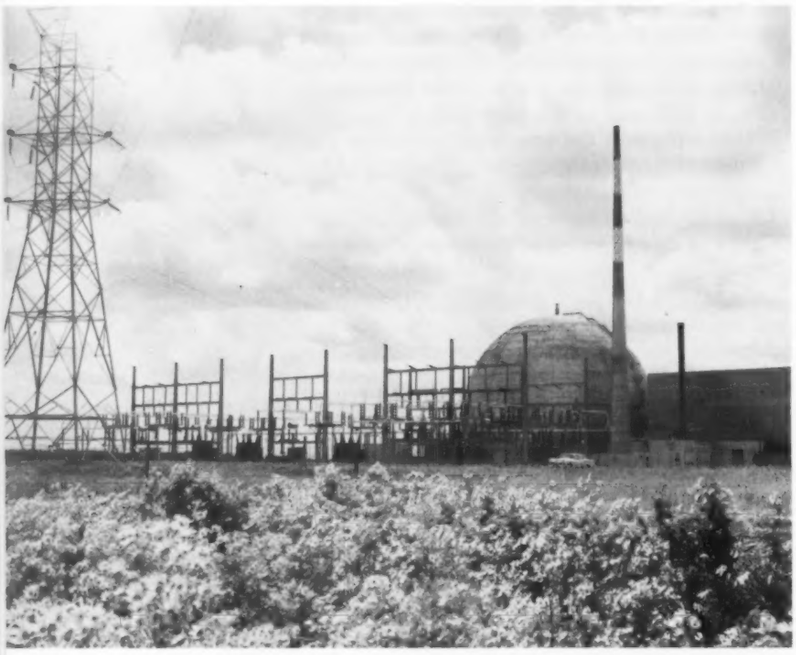
On November 28, Comrade N. S. Khrushchev himself delivered a long address to the conference. In the course of his speech, Premier Khrushchev discussed the time of construction and the basic reason for emphasizing thermal power, set up some new goals of completely electrifying Russia in the next 15 to 20 years, and also set up three new five-year electric energy goals beyond 1965. In terms of energy, he set specific kwh goals to be produced in a 15-year period beyond 1965 (see chart at left).

This projection, related to 1958 production and the 1965 goal, is interesting in that it contemplates by 1980 a ten-fold increase over the energy generated in 1958, and a four and one-half times increase over 1965. This may or may not be attainable even in the dynamic Russian economy. Also, the 1980 goal is the same as the conservative estimate of kwh generation in the United States by 1975, and which by 1980 is expected to grow to somewhere between 3000 and 3200 billion kwh.

Soviet–U.S. Comparisons Can Be Misleading

Of course, comparisons between ourselves and the Russians in specific sectors of the economy, such as electric power generation, will, unless one is very careful, always be misleading. To speak simply of total production, without reference to its allocation, is not very meaningful because of the ability of the Soviet leadership to direct the allocation of resources without regard to free consumer choice.

For example, we all know that the fact that the gross national product of Russia is roughly only half that of the United States does not mean that this automatically puts Russia at a disadvantage in the growth of their armed strength vis-à-vis ours. Their armament budget represents a much larger percentage of their gross national product than is the case in the United States. Similarly, the Soviet power program plan to achieve an annual production of



Burns

Nuclear energy will represent a significant item of energy supply over the next four decades. Above, the Dresden Station, largest all-nuclear power plant in the U.S., which is now sending electricity throughout northern Illinois.

on potential new energy sources."

500 billion kwh in 1965 (a figure reached in the United States in 1954), and a figure of 900 billion kwh in 1970 (a figure we expect to reach in 1963), need not mean that the electric energy available in Russia for the production of war materials will then be less than in the United States. The allocation of power use is as important as the total production of electric energy.

In terms of defense, the allocation of electric energy for wartime uses, such as armament production, may in part offset the much greater production in the United States in a final determination of relative military strength. Such an allocation can be made in Russia by direct rationing or by restricting the availability of electric energy consuming devices for the residential and low-priority industrial consumer. In our thinking about Russia we must not fail to reckon with imponderables of this kind.

Steps to Energy Availability

When one examines the possible steps that need and ought to be taken in order to assure the availability of the energy resources to meet the projected requirements of the United States, one is inevitably led to a series of rather obvious, but basically important, conclusions in three important areas:

1. Develop New Energy Sources

As to sources of energy, it is obvious that just as you cannot build today's skyscrapers with tomorrow's tools, you cannot provide the energy you need today with tomorrow's sources. The principal supply of energy over the next four decades is going to come from existing sources —coal, oil, and gas. At the most optimistic, nuclear energy will be able to supply no more than about 20% of the over-all total energy. Hence, the present sources need to receive attention to assure their economic viability and the optimum development of their technologies in every phase of their exploitation—exploration, extraction, and processing.

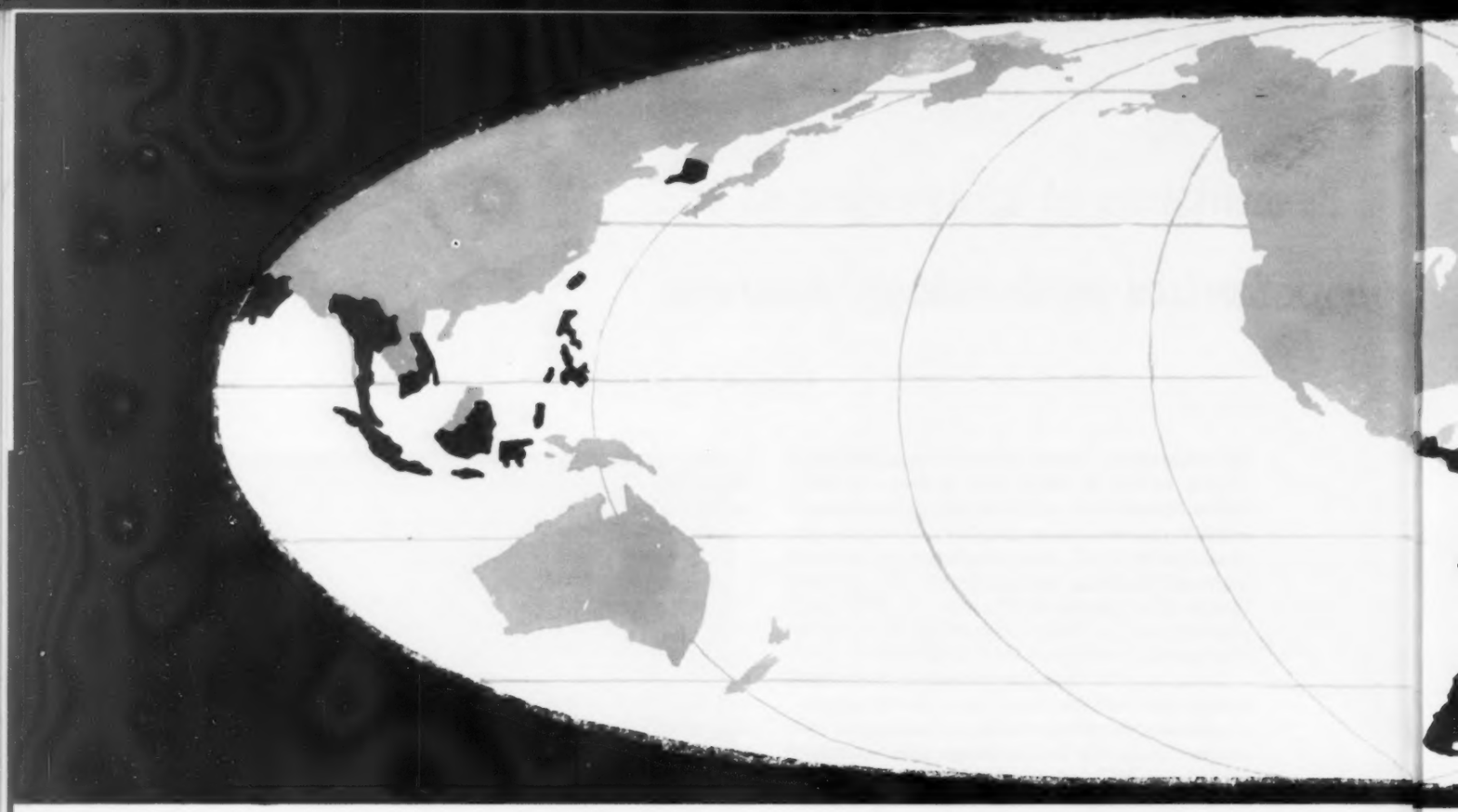
However, because of the estimated 150% growth in the utilization of energy resources from 1960 to 2000, it is important to continue developmental work and technological research on potential new energy sources. At the present time the only one of any practical significance is nuclear energy or nuclear fuel, which even at only 20% of the total energy supply four decades hence, will still be a very significant item and would be particularly so if it were missing.

2. Continue R&D on Existing Sources

Because of the growth in energy use it is important to continue effective research and development not only on the technologies of energy production, but on the technologies of energy utilization. In the case of electric energy, the techniques and the equipment for the generation of the electric energy from the primary sources—gas, oil, or coal—are particularly important. At 40% of total energy consumption in the year 2000, small increments in the efficiency of conversion will be reflected in a significant conservation of mineral fuels. At the present time there is no energy crisis of any kind in the United States. This is due in no small measure to the great improvement in the efficiency of conversion of raw energy into electric energy over the past half century and to the much greater efficiency in many areas of electric energy utilization, such as lighting.

3. Strengthen U.S. Social-Economic Organization

As to social-economic organization: The United States, with roughly 5% of the world population, has over a period of close to 100 years maintained world leadership in the production and consumption of both total energy and electric energy. The proportion of the world total has held for the last three or four decades at about 40%, with only minor deviations. That this has been possible in the face of a general awakening to the potentialities for enhancement of human welfare all over the world, particularly in the last several decades, cannot be due to mere accident or to the natural availability of energy resources in the ground. It must be, at least in part, due to the contribution of the social-economic organization that has evolved in the United States. It would be nothing short of great folly at this critical stage in the history of the world, and with the importance that energy will play in the maintenance of the kind of world in which the people of the U.S. are interested, to do anything to weaken this social-economic organization that has contributed so heavily to the present economic and military strength of the country.



Development Loan Fund: Areas for which loans have

American Private Resources i

by Vance Brand, Managing Director, Development Loan Fund

Although best known as an attorney, banker and industrialist, Vance Brand has on occasion been referred to as "the farm boy who made good in world finance." He owns and operates a 1700-acre farm in his native state of Ohio. However, as a George Washington University graduate, he began his career as a banker in Urbana, Ohio, has held bank executive and presidential positions, and has served on the board of directors of several corporations in his community.

Mr. Brand has been in Washington since 1953, first as Secretary to the Citizens Advisory Committee on Banking and Currency, then as director of the Export-Import Bank. Last September he was named managing director of the Development Loan Fund. He has traveled widely throughout the world in the course of all these positions, and is uniquely qualified to discuss the financial problems and development opportunities of foreign countries.

loans have been approved through January 31, 1960.

s in Overseas Development

The Development Loan Fund represents a new approach to managing U.S. financial resources, in an effort to help bring about economic breakthroughs in underdeveloped countries. The man who controls DLF's worldwide lending program explains what this means to the U.S.:

- **Foreign economic development improves American economy.**
- **The DLF opens broad new areas to American private enterprise.**
- **It offers practical encouragement of the American way of life abroad.**
- **It is an approach where we have the jump on the Soviets.**

Yesterday the frontiers of opportunity lay in the underdeveloped lands beyond the Mississippi. Today they lie in the underdeveloped lands beyond the seas—in Latin America, Asia, the Near East, Africa, and the Far East. Since Tokyo is now within 15 to 20 hours' flying time of San Francisco, perhaps we should begin speaking not of the Far East but rather of the Near West.

Here at home we have been able to make unparalleled use of our human and physical resources because we have a sound, well-motivated economic system based on private enterprise. Similarly, the full development of the resources and opportunities of underdeveloped areas overseas depends upon the establishment and maintenance of sound economic systems in those areas. We can best encourage the growth of such systems by bringing more countries into the natural network of spontaneous business relationships through which most of the Free World's commerce and enterprise are carried out. This in turn will require good management of one of our own most important and least recognized resources—our talent for the organization and management of business entities in a free society—so that it can make the most effective and appropriate contribution to the development task.

Our Economic System On Trial

Our economic system is now on trial in underdeveloped regions which make up the most populous portions of the world. The people of those regions are fully committed to swift economic progress, but they are not yet committed to our way of achieving progress. Their needs and demands would present a vital problem to our system even if the Soviet Union did not exist. But Communism does provide an important yardstick against which our system is being measured by a billion or more people in some 60 nations.

"This field . . .
is one in which
the Soviets have reacted
to our efforts,
rather than we to theirs."

For years the U.S. Government has been devoting considerable resources to the task of guiding underdeveloped nations toward the Western form of civilization. It has participated in international programs and has set up programs of its own, including those of the Export-Import Bank, the International Cooperation Administration, and the agency which I head—the Development Loan Fund.

The Development Loan Fund embodies a new approach, a new way of managing U.S. Government resources, in the effort to help bring about an economic break-through in the underdeveloped countries. It is an autonomous Government corporation established under the foreign policy guidance of the Secretary of State to make loans for specific projects or programs, public or private, which contribute to the economic development of underdeveloped countries. It is especially designed and empowered to help overcome one problem revealed by post-war experience to be a basic obstacle to economic development. That problem is the need of the developing nations for foreign-exchange financing, coupled with their inability to carry large burdens of hard currency foreign debt. Since the DLF is authorized to accept local-currency repayment, when appropriate, of its dollar loans, it can provide dollar financing without increasing the dollar debt load.

Congress has appropriated $1,400,000,000 to the Development Loan Fund for lending. The DLF has approved about $1,000,000,000 in credit commitments of various kinds for undertakings in 43 countries. It has under consideration projects which will absorb all the remaining $400,000,000 capital availability. President Eisenhower has requested the appropriation of an additional $700,000,000 in his budget for fiscal year 1961.

U.S. Economic Aid to 60 Countries

The U.S. Government's efforts to encourage long-term economic development in lesser developed countries constitute a positive program, which was established well before the Soviets entered the field. It is only in the past five years that the Soviets have rendered economic assistance to underdeveloped countries outside their own bloc, and their aid so far extends to 18 nations—the bulk of it to only six nations. By contrast, U.S. economic assistance efforts reach into more than 60 countries. This field of economic development is one in which the Soviets have reacted to our efforts, rather than we to theirs.

But government programs, essential though they are, are not enough to meet the challenges and trials of these times. They are inadequate, not merely because the government cannot possibly provide all the resources needed, but mainly because the bulk of the job consists of something that no government can do.

The underdeveloped nations possess no such reservoir of trained administrative and technical talent as we found in Europe during Marshall Plan days. In restoring the European economy, it was enough to provide the fruits of our economic system, in the form of plant and equipment to replace that destroyed by war. But the developing nations lack not only modern technology but the economic complex needed to use and sustain it and distribute its products. Therefore we must help them obtain not merely the products of a modern system, but the system itself. Naturally, without prejudice to their own beliefs and ambitions, we are eager to see them progress under a system of

Ambassador Carlos P. Romulo and Mr. Brand at the loan agreement signing ceremony between the Development Loan Fund and the Philippine Mindanao Portland Cement Corporation, October 26, 1959.

economic freedom, for we know by experience that free private enterprise calls forth more of the capabilities of a whole people, and contributes more toward the ultimate aim of human self-fulfillment, than any other kind of system yet devised.

Free Enterprise Cannot Be Imposed

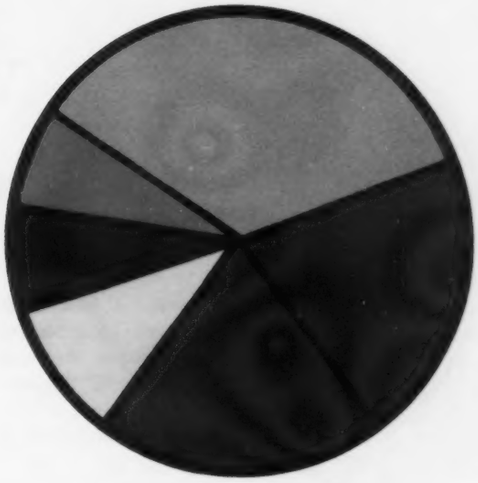
Such a system can be encouraged but it cannot be imposed. It must be demonstrated by example, and we can encourage its growth best by working with the people we aim to assist. Setting up business relationships with the producers of other lands; bringing them into the network of our system, and sharing its benefits with them; demonstrating the use and value of private property, and helping them to obtain it; establishing a middle propertied class with a personal stake in economic and political freedom—these are the things that count, and they are not things that can be done primarily by governments. They must be done mainly by free private enterprise.

Is it not a mistake to think of development assistance only as foreign aid? Rather, it is economic growth. Economic development creates wealth, trade, and opportunities. When new wealth is created anywhere in the world, we Americans have always received our share of it. Just as, a hundred years ago, the development of our Western frontier benefitted the developed Eastern seaboard, so today the development of less developed nations will benefit us in the United States. Our development programs overseas are American programs for—among other people—Americans.

This concept of growth is peculiarly American. Basically, the Soviets assist other countries in order to attract them into the Soviet political orbit. But basically we assist other countries in order to increase the sum total of prosperity in the world. We have learned by experience that it pays to increase the prosperity of the common man. This is the principle that distinguishes the American type of civilization from past civilizations, and is the basis of our approach to other nations.

Partnership with Private Enterprise

Thus it is clear that with respect to the underdeveloped nations, the interests of private enterprise and of the U.S. Government coincide and complement each other. It follows that they should work closely together in the pursuit of their mutual interest. The achievement of a working partnership with American private enterprise is a major drive of the Development Loan Fund.



BREAKDOWN OF DLF LOANS

($958 Million Through Jan. 31, 1960)

- AFRICA
- FAR EAST
- NEAR EAST
- LATIN AMERICA
- SOUTH ASIA
- EUROPE

Private enterprise needs such a partnership just as the government does. Excluding investments for oil, in recent years new U.S. private investments in Africa, the Near East, South Asia, and the Far East put together have amounted to about $60,000,000 a year. A good many American counties have larger budgets than that. Yet American private enterprise has never been known to turn its back on opportunity without good reason. We believe that the Government can help overcome some of the obstacles that have kept American private enterprise from assisting the opening of the vast potential opportunities that exist in the less developed countries.

Your U.S. Government helps finance basic non-profit facilities such as roads, railroads, harbors, and communications, which form the foundations for private enterprise, both local and American. It encourages and assists local private enterprise, and thus fosters the principle of private enterprise in societies still being formed. With its own development programs, it helps to guide the growth of the developing countries during the period while American private enterprise has not yet extended its network of relationships into those areas.

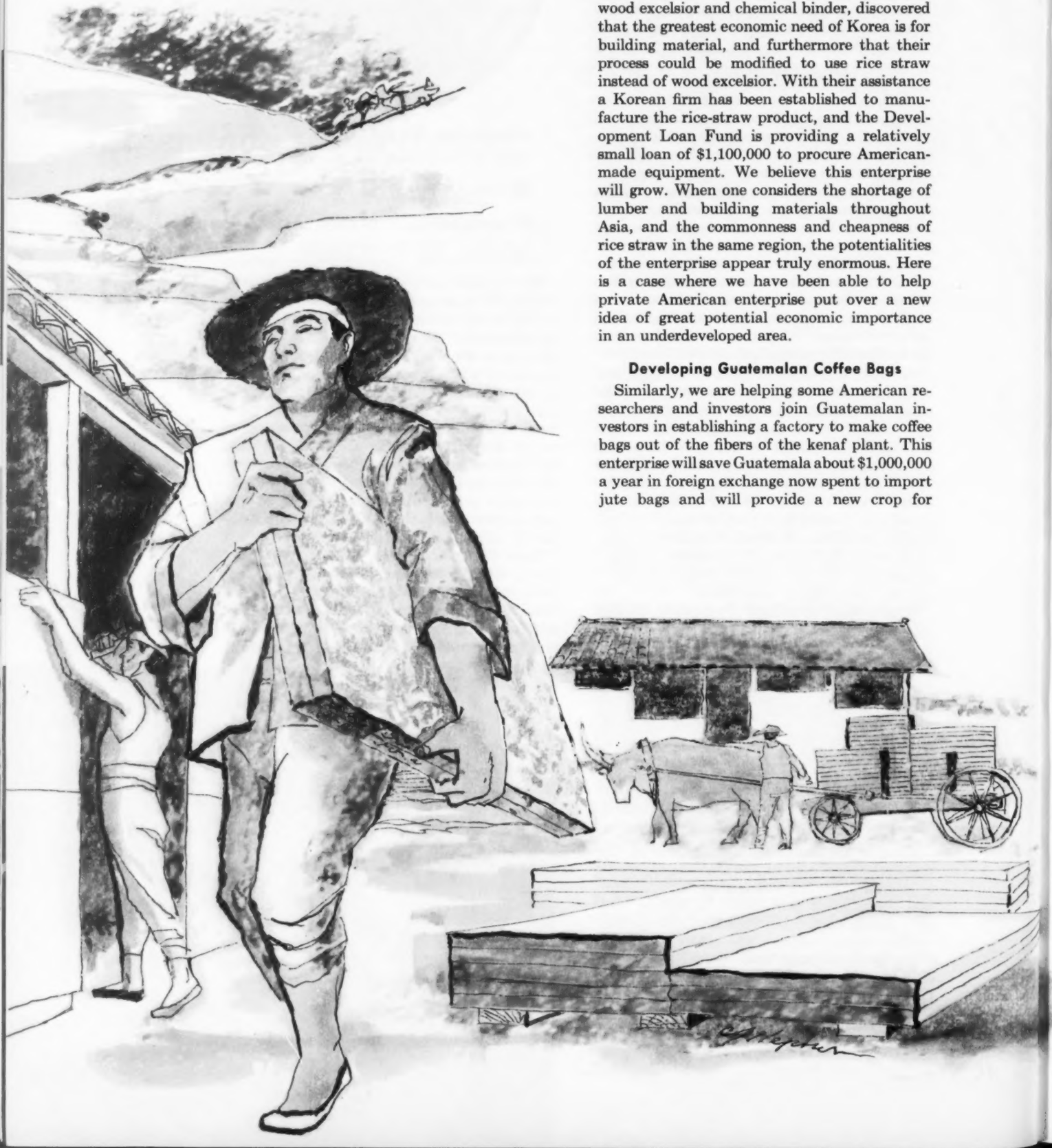
Now we believe the time is ripe for more direct measures of cooperation. The Development Loan Fund's unique powers enable it to share risks through joint undertakings with U.S. and local private enterprise. We would like U.S. enterprise to undertake an effort in cooperation with us to make the fullest possible use of our assistance.

Building with Rice in Korea

Some U.S. enterprisers have already found the way to our doors. For example, officials of the Tectum Corporation of Columbus, Ohio,

". . . in the economic field the

to serve enterprise,



who make a flexible building material out of wood excelsior and chemical binder, discovered that the greatest economic need of Korea is for building material, and furthermore that their process could be modified to use rice straw instead of wood excelsior. With their assistance a Korean firm has been established to manufacture the rice-straw product, and the Development Loan Fund is providing a relatively small loan of $1,100,000 to procure American-made equipment. We believe this enterprise will grow. When one considers the shortage of lumber and building materials throughout Asia, and the commonness and cheapness of rice straw in the same region, the potentialities of the enterprise appear truly enormous. Here is a case where we have been able to help private American enterprise put over a new idea of great potential economic importance in an underdeveloped area.

Developing Guatemalan Coffee Bags

Similarly, we are helping some American researchers and investors join Guatemalan investors in establishing a factory to make coffee bags out of the fibers of the kenaf plant. This enterprise will save Guatemala about $1,000,000 a year in foreign exchange now spent to import jute bags and will provide a new crop for

Government should exist rather than the other way around."

Guatemalan farmers. We are helping some investors in Detroit set up a sawmill in Liberia, in connection with Liberian investors. At present Liberia imports lumber although it has millions of acres of forest. We have helped a firm with joint American and Chinese ownership expand a shipyard on Taiwan. We are helping an American corporation expand and modernize a meatpacking and ranching operation which is Paraguay's largest earner of dollar exchange. I could cite other examples in which the DLF has helped American capital and talent develop creative opportunities in cooperation with the people of other countries.

We want to see this kind of activity carried out on a larger scale and on a more systematic basis. We would like to see American private enterprise deliberately search out opportunities for joint investment in underdeveloped nations, and then consult with us on the best means of establishing productive industries. This has already begun to happen. We are now considering a transaction in which the Development Loan Fund, certain important American corporations and financial interests, and certain local private investors may join resources to finance, construct, and manage a new industry in the multi-hundred-million-dollar range of magnitude in a country which has been receiving U.S. development aid. Serious discussions are under way toward forming a similar investment combination to operate in a different underdeveloped country. We have opened discussions toward the formation of a third group interested in petro-chemical industries in still another developing country. Thus a pattern for partnership is being formed and implemented in specific actions.

World Development Workshops

Furthermore, in cooperation with the Department of Commerce, we plan to hold periodic "workshops" in which representatives of Government agencies and senior corporation officials will take part. Through these seminars and in every other way we can devise, we shall continuously seek to broaden the participation of American free enterprise in the task which confronts us in the developing regions of the world.

We in the Government mean to play our due part in organizing and carrying out our partnership with enterprise. But we do not believe it should be the kind of partnership in which Government forms the program and private enterprise supports it. Both free enterprise and Government are essential to the success of the endeavor, but fundamentally I believe that overseas, as at home, in the economic field the Government should exist to serve enterprise, rather than the other way around. The latter road leads toward statism, which is the opposite of what we are trying to accomplish.

We in the Development Loan Fund are still learning how to make the best use of this new instrument for economic growth. It will be some time before the projects we are assisting can manifest their full effects. Even after the factories are built and turning out products, and the roads and railroads are complete and carrying traffic, the full story will still remain to be told. For our loans are for creative undertakings that can lead to further enterprise. The transportation arteries will open new areas to settlement and development; the communications systems and commercial facilities will stimulate the flow of trade; the factories and industries will give rise to secondary undertakings of many kinds. Not all of our loans are for spectacular monuments of development, but they all will help bring about ever-increasing well-being in the countries in which they are made. They will contribute to our objective of establishing a prosperous citizenry in each underdeveloped country, who will at once support the continued growth of their own nations, increase the volume and variety of world trade, and form the best possible encouragement of our American way of life among our friends abroad.

This effort merits the finest talent our nation can put forth. The Soviets are sending their best men into the underdeveloped countries—men capable not only of building and directing projects, but of extending the influence of their system at every opportunity. They must more than meet their match in Americans equally capable of representing and strengthening the system of free private endeavor. We must meet their first team with our first team; and our first team must necessarily include the best talent available in American private enterprise.

The Soviet government can deploy all the talent of its nation in the service of the State. The U.S. cannot order its business brains here and there; this would violate our basic principles of freedom. Therefore we must rely on the voluntary efforts of private enterprise—encouraged and supplemented by our Government—to cope with Soviet statism in the pivotal underdeveloped regions. It is up to American firms to come out for the team. Today there are no spectators.

Burns Mr. Luntz Mr. Hochgesang Mr. Mason Mr. Kramer Mr

Moderator Kenneth Kramer, Managing Editor, BUSINESS WEEK, since 1954, with the magazine since 1946; member of the McGraw-Hill Editorial Board; extensive journalistic background includes Washington news editor of WALL STREET JOURNAL, and city editor, advertising manager and publishing positions with Indiana, California and Illinois daily newspapers; Washington representative for the Automotive Council for War Production during World War II; writing contributions include "Fundamental Research in Administration" (1953) and "The Bureaucrat" (1942).

Charles F. Hochgesang, Editor, ELECTRICAL WORLD Magazine; extensive electrical industry background, including electrical engineering supervision on large utility power projects, nuclear power studies, and heavy industrial construction for Bechtel Corporation, San Francisco; member of the U.S. National Committee of the International Conference on Large Electric High Tension Systems. Registered professional engineer in California.

Robert B. Hotz, Editor, AVIATION WEEK Magazine, and one of the original staff members; reporter of aviation activities on four continents for 20 years, and during the past ten years has covered every major air show including the Paris Air Show, the British Air Show at Farnborough, and the Russian Air Show at Tushino; in 1956, accompanied the official USAF mission to Moscow, reporting first hand on latest Soviet jet aircraft developments; was part of the 1959 U.S. delegation to the Federation Aeronautique Internationale Conference in Moscow; holds the Air Medal for World War II combat operation in China; author of "With General Chennault, The Story of the Flying Tigers," and edited the General's memoirs, "Way of a Fighter."

Jerome D. Luntz, Editor and Publisher, NUCLEONICS

Mr. Hotz

Formula for the Future: *stronger goals– better communication*

A Panel Discussion by Five Editors of McGraw-Hill Publications

These McGraw-Hill Publications (AVIATION WEEK, BUSINESS WEEK, ELECTRICAL WORLD, ELECTRONICS, and NUCLEONICS) represent a cross section of business magazines. In this exclusive *Defense Quarterly* panel discussion, their editors analyze the manner in which U.S. total resources are being used.

Magazine, joined McGraw-Hill in 1947 to help publish first issue; chairman of the McGraw-Hill Editorial Board; a founder, past vice president and key official of the American Nuclear Society; founder and first president of Nuclear Energy Writers Association; chairman of Glossary Subcommittee of the Nuclear Standards Board of the American Standards Association; associate editor for the McGraw-Hill Book Company Nuclear Engineering Series.

John F. Mason, Associate Editor, ELECTRONICS Magazine; an Air Force background in the technical and business aspects of military electronics; World War II navigator with 32 combat missions, Director of Flight Training for the Pathfinder Radar School; head of the Loran School; recalled to the Air Force in 1951, studied International Relations at Georgetown Graduate School, and served as psychological warfare officer in Libya and Munich.

"Isn't technology actually our greatest re

MODERATOR KRAMER: During World War II, through the tremendous job we did in not only arming ourselves but our friends and our allies, we earned the title of Arsenal of Democracy; at the end of the war, the United States was clearly recognized as the Number One industrial nation in the world.

Because of the terrible price that some other nations had to pay in World War II, it became vital that their economies be aided in a reconstruction and recovery program. It was up to us to meet this challenge, and we did through such things as the Marshall Plan and other foreign aid programs that were developed later.

It has become apparent in the last year or two that these programs were remarkably successful. For example, we are now beginning to feel the competition from the various countries that we have helped in the last 15 years, and it does present a problem at this time in regard to managing our resources for defense and/or prosperity.

I think we are going to find ourselves perplexed quite often as to what resources we are talking about, how we are going to manage them, and who is going to manage them.

Is the job going to be done by government primarily? What is going to be the role of private industry in this area?

MR. LUNTZ: I think that the most significant resource that we have, and the thing that we have got to pay the most attention to, is the American mind, the man, the individual. The potential of this country depends entirely on our capability of making use of American ingenuity, talent, and resourcefulness.

Perhaps the most distressing thing that has occurred in the past decade is that we have fallen behind in the ability to use our resourcefulness. We are operating and thinking from a defensive point of view. We are not looking at ourselves as a country that has tremendous potential. In many areas we have become a follower instead of a leader. The most important thing that we need to do as a country is to encourage individuality.

We have been followers instead of leaders in the space field. In the field of peaceful atomic energy, despite the fact that we have been a leader in many aspects of it, the broad outlines of the program have come as a result of pressure from other countries. So, in managing our resources there is a need for leadership, a need for individuality, and a need for encouraging nonconformism.

MR. HOCHGESANG: Traditionally, before various wars we have been in the position of not being in the forefront of certain advances. We usually manage to catch up when the chips are down. But, for this discussion, we must define whether we are talking about

Burns

Mr. Luntz Mr. Hochgesang Mr. Mason Mr. Hotz

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preparing for a hot war or a cold war.

Responsibility for Leadership

MR. HOTZ: You can't prepare for one and not prepare for the other. You can, but it would be rather silly. Our national strength is not of much point in the current situation, except as it can be applied in the over-all situation of the world. Whether we like it or not, we are the leader of the Free World, against the Communist bloc, and people all over the world look to us for leadership. George Allen, Director of the U.S. Information Agency, described to one of the House committees, not long ago, the tremendous influence that space technology has had on our international prestige among allies, neutrals, and Communist satellite countries. We have to face up to the reality that space progress is a measuring stick.

International Measuring Sticks

MR. HOCHGESANG: Would you extend this business of international measuring sticks to every segment of our economy, or do you think that space and nuclear power are special cases?

MR. HOTZ: In every era there are certain technologies that are the key to development. There is no question that the three key technologies in our modern times are nucleonics, electronics, and the very broad field of aero-space.

Two trips to Russia led me to believe the Soviet leaders recognize these as the key areas of power. This is why they are concentrating so heavily on them.

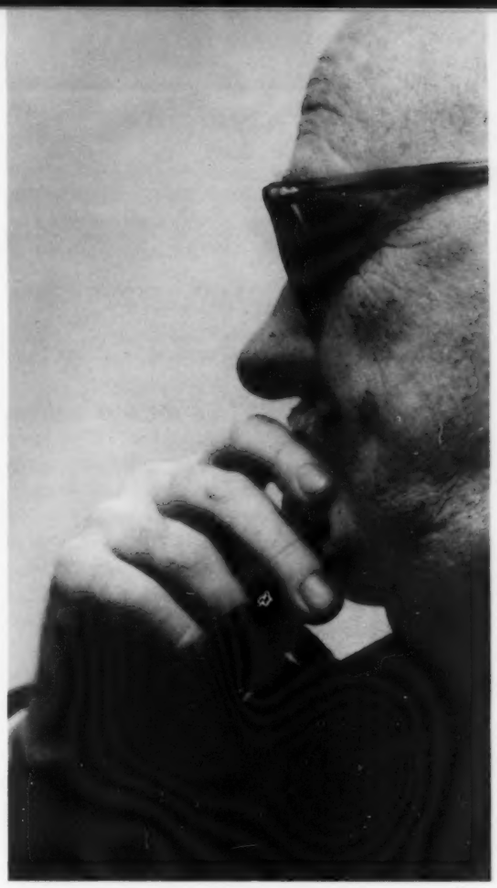
MODERATOR KRAMER: Isn't technology actually one of our greatest resources?

MR. HOTZ: Yes, and we have been the traditional leaders in technology. This is what distresses so many people abroad. They cannot understand why we are not maintaining our leadership and why we don't even seem to want to.

MR. HOCHGESANG: We recognize that world leadership is vital and that there are two areas in which we must lead. One is in technology, and the other in economics. We have to manage our technology programs so we do not upset the over-all balance of the two areas.

Soviet Management of Resources

MR. MASON: With or without an outside threat there is always a need for improvement. To keep our society going we have to improve. Any let-up in progress means going backwards. We continually need better management of our resources to meet changing conditions within our own society.



Burns

Moderator Kenneth Kramer—BUSINESS WEEK

One of the many techniques Communism is using in its effort to annihilate capitalism is fighting us with our own weapons: technical and scientific inventiveness and achievement, mass production, and salesmanship—domestic and world-wide.

In handling this weapon, Russia appears to be managing her resources in a highly effective manner. Russia's successes are partially due to the singleness of purpose possible in a totalitarian state. This is perhaps made even easier for them due to the enthusiasm that is generated by a pioneer-like stage of development. Also, since they haven't yet achieved the fruits of their labors they haven't been polluted by the negative consequences that accompany the good, such as dedication to comfort, gadgets, and complacency.

Confusion in Direction

MR. LUNTZ: I think we come back to the point of not knowing what it is that we really want as a country, what we want as individuals. One area of confusion is the energy field. We haven't really been concerning ourselves with what are our engineering resources, what are our reserves, what is the long-term requirement for different kinds of reserves.

Perhaps instead of using all of our coal for central power station purposes, we should set it aside for the time when we may want to

"We . . . need to encourage free, open thinking on the part of the individual."

use it totally for chemical purposes or other purposes than power production. Perhaps now we should be using other sources of fuel—whether they be atomic energy or something else. We should at least be carefully considering such things.

Another basic question is, how do we make the United States really strong in the field of science? Does the Federal Government come into the picture in a bigger way, and, as has been done in the atomic energy field, build a series of national laboratories at the cost of billions of dollars? Does private industry step up its expenditures substantially and support the development of science? Do the universities do this?

There isn't any one answer. The universities and some of the government laboratories must work on the forefront of technology. Industry must be in a position to pick up and move developments into the applied stage. On the other hand, the government must have a desire and a willingness to have industry as a partner and not push industry off as a threat to government structures or government laboratories.

MR. HOCHGESANG: There is controversy as to whether we should develop our hydro resources faster, whether we should take their development away from the traditional economic concept of being by-products of navigation, flood control, and irrigation. Such a speedup is completely unnecessary, in the face of our complete wealth of other natural energy resources. Where hydro can stand on its feet economically—using valid economic measurements—or where it can be developed as rightful partner with irrigation, navigation or flood control, then it should be developed. But to develop hydro power for hydro power's sake is to lose sight of the over-all problem: the most *efficient* use of all our natural energy resources.

U.S. a "Have Not" Nation?

MODERATOR KRAMER: Isn't it true, though, that over a period of years the position of the United States as a "have" nation, as far as many natural resources are concerned, has changed to that of a "have not" nation, in that we are relying more on foreign imports of certain basic materials?

Certainly the idea of importing petroleum is a rather significant development. And we certainly are big importers of copper, nickel, and iron ore.

MR. LUNTZ: Basically though, for centuries to come the United States is in a position where it can consider itself to be in an energy-independent status. We have now and we have looming ahead in the future a capability which permits us to be free of any necessary ties to other parts of the world.

MODERATOR KRAMER: Our problem on economic competition, at the present time, is more a competition between the United States and Western Europe and Japan than with the Soviet Union. You would have to look ahead several decades before you would have an all-out economic competition with Russia. Everybody gets carried away by percentage increases in the Russian economy. But looking at the base from which these percentages are constructed, it is evident that Soviet Russia still is a long way from becoming a real economic threat world-wide, if they are going to improve their own internal situation.

Much of what we hear about Russia's economic operations are such things as their recent deal with Cuba on buying sugar. Actually, that is more of a harassing operation, and was motivated primarily politically, rather than economically. It is more likely to be made part of a triangular trade deal, again in an effort to curry political favor with some of the countries that are either in the Communist Bloc today, or nations that they would like to draw into their sphere of activity.

Reward for Success—Penalty for Failure

MR. HOTZ: Another key point in managing our resources effectively: How much reliance are we going to place on, and how much authority are we going to pass down the line to, the basic private industrial and scientific re-

search institutes and university groups? How much are we going to try to centralize within the top levels of the government? This is where we made one of our big mistakes, and where, oddly enough, the Russians are following exactly the opposite course, although they are supposed to have a highly centralized system.

In much of their decision-making processes, particularly in the military-technological field, the Communists place the responsibility directly on the man who would be the equivalent of our project engineer or company president. He and his group get the rewards if they are successful, and they suffer the penalties if they fail. Both are very sharply defined.

Andrei Tupolev, the chief Soviet aircraft designer, made it very clear how their system works. He pointed out how he now, as a result of his successes with the Tupolev transport and bomber series, had a 50,000-ruble tax-free bonus, a house in the country, and a car that could drive him down the middle of the street in the white lanes reserved for officials only. Then he sort of laughed, and said, "Of course, I did spend three years in jail."

MODERATOR KRAMER: As far as the availability of resources is concerned we probably have an abundance or a super-abundance in the area of technology, but don't we have a problem in trying to get scientists to develop it? Aren't we facing a problem in the area of education, of getting more trained people.

MR. LUNTZ: Education is an area of concern, but I don't feel that the quantity of nuclear engineers, space technologists, and so forth, is as important as the quality. We do need to encourage free, open thinking on the part of the individual. We must encourage ideas and the development of ideas. We must make sure our educational system—our universities—don't take people down a narrow, specialized path.

MR. MASON: I was reading that the number of engineering students enrolled this past year is below that of the previous year. Although it's good to have a broad view of physics and science, our industry today certainly requires more specialized men.

MODERATOR KRAMER: My next-door neighbor is a man who has been in the business of making electronic equipment for radios and television, and industrial applications, for about 40 years. He told me recently that a graduate of MIT today, in the field of electronics, has to know as much about electronics as he has acquired in 40 years of experience.

MR. LUNTZ: I think there is a need for specialists, but we shouldn't go so far along the road of specialization that we ignore the person who has a fundamental, basic grounding, upon which you have the opportunity for developing creative thinking.

Mr. Hotz—AVIATION WEEK

Burns

Need for National Goals

MODERATOR KRAMER: One theme seems to be central: We don't have national goals really established.

MR. MASON: I think so long as our goals are formulated as reactions to an outside force—what the Soviet Union is doing, or worse yet, what we think they are doing—we will have difficult management problems in government and in industry.

There are, of course, many other factors that disrupt any clearly defined objective or course of action. Appropriations for, and approval of the efforts of both the National Aeronautics and Space Administration and the Defense Department depend on the unpredictable changes in Congress and the degree of understanding of the people.

On the positive side, NASA has been given authority to plan ahead for the next 10 years. The Defense Department's Director of Engineering and Research office has been set up for the purpose of advanced planning, aimed

Mr. Luntz—NUCLEONICS Burns

at preventing duplication of effort and much of the waste that has been so costly in the past.

MR. HOTZ: There have been a number of studies and reports on goals. The Gaither report was one of the most significant; the Rockefeller report; and an MIT study. The interesting thing about these reports is that most have been classified, and their contents not disseminated.

MR. LUNTZ: We as a country pay lip service to the concept of the free exchange of ideas and information. We think we believe that the American public and the American industry have a right to know about what is going on in our government, but the fact is that this isn't happening. It would be useful if there could be fostered and encouraged a wider public discussion of basic issues than we now have.

President Eisenhower started the American Assembly, sponsored by Columbia University, which in a small way is bringing together people from very diverse backgrounds to discuss issues that are central to the country. But the individual citizen needs to be brought in on this a lot more than he is. Many companies have been looking favorably on the idea of businessmen getting involved in politics. I think the healthiest thing in the world for this country is to encourage individuals at every level to participate in trying to influence and mold the political, social, and economic life that we are part of.

Poor Communication Slows Progress

MR. HOTZ: It goes even deeper than that. It also extends into the technical field. One of the problems that we have, particularly in areas of defense and space, is that there are no well-organized or fast-flowing channels of communication for technical information in this country. The present government "need to know" philosophy results in failure to disseminate technical information to people who are working in the field, or even at top government levels. The technical time lost far outweighs the security gains, and leads to unknowing duplication. People end up working on a particular problem that was solved by somebody else three or four years ago.

MR. HOCHGESANG: The problems of poor information flow and duplication of effort also exist in areas where there are no security restrictions and where some of the decisions are just as vital. An example in the nuclear field was the failure to predict the present European fuel glut, which has completely changed European nuclear economics. There were people in Europe and probably people in the United States who could have predicted this fuel situation; yet it caught decision makers on the nuclear front completely flat-footed. One of the results is the sudden change in scope of the Euratom program.

Duplication Sometimes Good?

MODERATOR KRAMER: From the standpoint of greatest efficiency, duplication of effort seems to be bad. But, isn't it true that duplication of effort sometimes is a very good thing, because of the inherent spirit of competition?

MR. HOTZ: The distinction is that you need duplication and the multiple approach in the early exploratory research and development phase. Where we make a basic mistake in managing our defense resources is that when we have developed a defense solution—and very often we will develop two or three successful approaches to a single problem—we don't make a decision then, on what our production programs and military forces in being are going to be.

The *Atlas* and the *Titan* ICBM programs are good examples. Two approaches were necessary in the early phases of development, when we didn't know whether we could build a vehicle that would go 7000 miles and hit within a mile of where we wanted it to with a multi-megaton warhead. But now that we know we can do that with either, there is a large question as to whether to continue to produce both of them. To do so on a production program involves large wastes of money on the order of $5, $6 and $7 billion. R&D duplication, on the other hand, involves comparatively small amounts: in the order of $50 million or $100 million.

The Financial Resource

MR. HOCHGESANG: One of the resources that we haven't mentioned is the resource of finance. We can go ahead with heavy deficit financing, and perform almost any program we want to, but this in turn affects the economy. If we are indeed in an economic conflict with the opposing ideology, this must be taken into consideration.

relationship between business and government."

MR. HOTZ: I think most of the people who have really studied this defense problem do not feel that any sizeable monetary increase is necessary in the program. It is more a question of getting more value received out of the money that we are spending.

MR. LUNTZ: The Atomic Energy Commission has just come out with a very nicely spelled-out ten-year program for achieving economically competitive atomic power in the United States. The question that we never really answered is: Why ten years? Why not five years, or eight years, or fifteen years? And if it were eight years, how much more money would this cost us? Would the incremental cost of making it eight years instead of ten years be so big that it doesn't make sense?

If you answer these questions then there is a basis for balancing the importance of this goal in the atomic energy field, as against a goal in the medical field or in any other areas of our economy.

Goals vs. Free Enterprise

MODERATOR KRAMER: Is there a conflict between goals and free enterprise?

MR. LUNTZ: I believe that having clearly defined goals and moving toward these goals is not at all incompatible with a free enterprise system. In fact, what we need to do is to take advantage of the free enterprise system, of governmental support, of governmental activity. We need a closer relationship between business and government. We cannot be working in two isolated parts of the economy. There are certain things that it is important and proper for government to do, and certain things that industry must do.

There needs to be a much greater influence by industry on the government. If business has been deficient in any area, it has been deficient in the degree to which it has been able to impose its thinking and ideas on the establishment of national goals.

The government has set up a committee to study national goals. Even though I believe there are some businessmen on the committee, one thing that industry might have done before now is to have set up its own committee for recommending what the national goals should be, and to have given extensive publicity to these goals.

MR. HOTZ: I don't think there is any basic conflict between the idea of national goals and private enterprise. I think your national goals are broad, generalized concepts, and your private enterprise fits into that in providing specific solutions to them.

For example, in the space race, private industry—our scientists, engineers, and industrialists—is providing much hardware and supporting many specific projects aimed at enhancing our international position in this field. Private enterprise support is there, even when the goals aren't defined and are just created as a result of general public pressure. In the space field today the force of public opinion is creating a goal of international leadership.

The Role of the Man in the Street

MR. HOCHGESANG: I don't agree completely. It seems to me that the real function of public opinion is to insist that these goals be set and adhered to. But right now the man in the street has insufficient information to be able to take a coherent part in the actual setting of the goals. On the other hand, the public has never been better equipped to express itself on these subjects than it is right now, thanks to improved communications and better educational background.

MR. LUNTZ: I think one of our goals should be to see that the man in the street has—not a great set of detailed reports that he can dig into and come up with specifics on legislative recommendations—but that he has enough information to have an understanding of what the specific issues are.

MODERATOR KRAMER: The individual citizen, of course, has an opportunity to express his opinion on the national goals, or any other subject along that line, through the exercise of his right to vote.

In this national presidential election year, it will be interesting to see how the various candidates explain their position on some of these things, to the satisfaction of the growing intelligence of the average citizen.

Mr. Mason—ELECTRONICS

Burns

"...national goals...are just as compatible with... prosperity as...defense."

Priority Goals for the Future

MODERATOR KRAMER: Let's get specific. In agreeing that we should have a strong set of national goals for effective management of our resources, we have touched on several areas. Perhaps we can identify or sum up what should be some of our priority goals of the future.

MR. LUNTZ: The broadest possible goal should be to develop the strength of the United States as a nation in the world community of nations, to develop as a strong country, to keep strong in science and technology, in our ability to help other countries in the field of human, sociological, economic needs. And, of course, we must have a primary goal of developing the understanding of the American public much beyond what it is today.

MR. HOTZ: We should have a certain broad defense goal: aim at maintaining a defense establishment of sufficient superiority to enable us to prevent any aggression on the part of other nations in the world, and to back our own positions in international affairs.

Unless we can regain the clear margin of military superiority we enjoyed in the era of our monopoly in atomic weapons and intercontinental delivery systems, we will have difficulty in truly deterring potential aggressors. The only possible way to regain that superiority is through an aggressive and sustained military research and development program that will explore the expanding technical frontiers fast enough to keep us ahead of any competition.

MODERATOR KRAMER: Then one of the national goals, not only in the defense area but over-all, would be a continuing emphasis on the area of R&D. And this is an area in which private enterprise should undoubtedly play a bigger role than the government.

MR. HOTZ: But the bulk of R&D money goes into private industry. This is one of the reasons why there must be adequate profit in the defense business. To finance more and more of this vital R&D on its own, private industry must get some return on its operation.

MODERATOR KRAMER: I think industry still could get encouragement in several different ways, to make it possible for them to develop more in the R&D area. The tax situation is one area. I don't think there is any real encouragement given to business, as it should be, in connection with such expenses.

From a world trade standpoint, U.S. exports are falling off, while imports are rising. Eventually we will get to a point where U.S. exports are not going to consist of durable goods, such as automobiles. Aside from perhaps some agricultural exports and certain industrial raw materials, we may have to rely almost exclusively on innovational products, things that we have developed ahead of the rest of the world. That will be the way we will be able to hold our world trade position. We should have a goal of keeping ahead in this area.

MR. LUNTZ: There are capable technologists and industrialists in Western Europe and Japan. If we come up with a new idea, it is a very short period of time—perhaps not more than three to five years—before these people, if they have not done work in this particular area, have picked it up and are producing on their own.

From what I have seen in my own field, the government has not worked as closely with industry as it should have in the establishment of a patent position abroad. The government has, in fact, impeded private American industry on establishing a patent position, because for political reasons we are effectively giving away our technology and our know-how. We hurt our export business because of this.

MR. HOCHGESANG: Recognizing that private enterprise is the best equipped in general to handle defense work, then we must have a national goal of making sure that private enterprise has the necessary incentives to take on the work. We must not get into situations where the profit margins are cut so thin that they simply aren't interested in getting into defense business.

Mr. Hochgesang—ELECTRICAL WORLD

Burns

Is Business Doing Its Job?

MODERATOR KRAMER: Has business done an adequate job of explaining this situation? Is this an area where business has defaulted on one of its obligations: to explain not only to government, but to the nation what this really means and what it takes to keep this economy growing?

MR. HOCHGESANG: Often when businessmen come to the Congress or to the government to express themselves they are met with very unsympathetic ears. Although this is in the American tradition of conflict between government and business, we can no longer afford to follow that tradition.

MR. HOTZ: I think part of it is that business goes to government with too defensive an attitude. I think that business has done a deficient job in explaining its problems and its position to the legislative branch of the government.

It goes back to the Nye investigation and the "Merchants of Death" tag. This is something that everybody has been scared of since 1932 and 1933. But when somebody like Bill Allen, President of Boeing Airplane Company, goes to Congress, takes the stump, answers their questions and says, "Now I'd like to tell you a few things about what running an airplane company is like," and makes a positive, aggressive, and factually supportable statement, they have been pretty responsive. But if you go up and say, "Yes, sir; no, sir; no excuse, sir," you don't get that kind of response.

MODERATOR KRAMER: A lot of people think that the government is nonreceptive to business ideas. Yet I have observed that they are just dying to get some information; but those in government find it very difficult to get.

MR. LUNTZ: Business leaders haven't developed a broad enough perspective so that when they come to Washington, or wherever it may be, they come with a sense of understanding the weaknesses and the strengths of industry. If they show a perspective and understanding of the basic problems of the economy with which they are concerned, they will be listened to respectfully.

MODERATOR KRAMER: And you need an informed legislative body to make intelligent decisions.

MR. LUNTZ: Here's a specific suggestion from the atomic energy field, which has worked out extremely well. The Atomic Energy Act of 1954 requires that there be annual hearings in the first 60 days of each session of the Congress for the purpose of reviewing the state, the health, the development of the atomic energy industry. Why wouldn't it be a useful idea for some congressional committee—maybe the Joint Economic Committee—to have annual hearings assessing the health, the state of the United States economy, the United States situation in the world? If this were done, we might have a basis for examining crucial issues, and not have to wait until we are forced to.

Benefits to Defense and Prosperity

MODERATOR KRAMER: The various national goals that we have attempted to develop in our discussion are goals that are just as compatible with the desire of managing resources for prosperity as they are for defense. Are there other thoughts on this?

MR. HOTZ: Our basic military research and development investment has a tremendous payoff in the civilian economy. There are numerous examples of things that came out of World War II: the whole plastics industry, synthetic rubber. Such developments are too large in the beginning to finance privately, or without some government stimulus, and yet the payoff in new products and even basic new industries in private industry has been tremendous over the years.

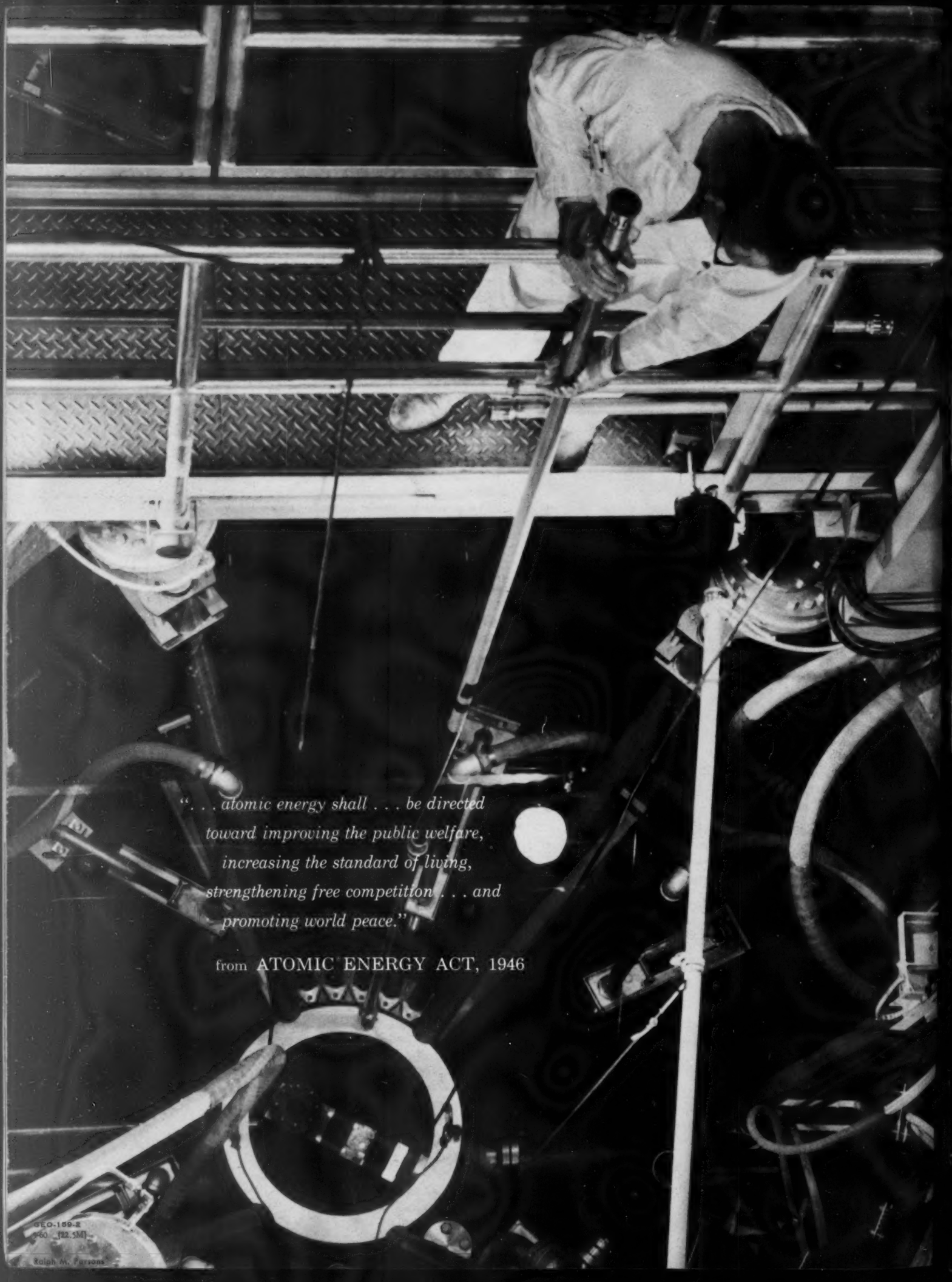
The same thing will come from space technology. This will be a basic capital investment as far as the country is concerned, and there is going to be an enormous amount of commercial development eventually. Some can already be seen in the communications area. Space developments are going to revolutionize global communications, international television. The *Tiros* weather eye satellite already has provided the technical basis for a whole new approach to weather forecasting.

MR. LUNTZ: In this connection, perhaps an over-all goal in just one word is "Growth." We are living in an economy where science and technology are playing such a basic and such a significant role that we are faced with what I feel is an inevitability of growth of the country in strength, in the economy, in prosperity, assuming other factors don't go haywire.

MODERATOR KRAMER: In dealing with the problem of managing our resources, it is certainly industry that has the responsibility of handling the major resources that we have been talking about. Industry itself produces the material things that people are concerned about. It is industry that is interested in these problems.

As far as the whole economy goes, we are very fortunate in that this nation is very rich. It is rich in its resources of manpower, brain power, physical facilities, and educational facilities. Therefore, we are still in a very good position to actively carry out the role of one of the leading world powers.

In a period of 150 years, this nation has established a rather remarkable record, and I would be very much surprised if that record were thrown in the ash can at this time just because we were not able to face up to the increasing responsibilities that are being placed on us.


"... atomic energy shall ... be directed
toward improving the public welfare,
increasing the standard of living,
strengthening free competition ... and
promoting world peace."
from ATOMIC ENERGY ACT, 1946
GEO-159-2
Ralph M. Parsons